

Review of the *Lithoscirtus* genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species

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Review of the *Lithoscirtus* genus group (Orthoptera, Acrididae, Proctolabinae) with description of new species. - The genera *Lithoscirtus* Bruner, 1908, *Drymophilacris* Descamps, 1976, and *Drymacris* Descamps & Rowell, 1978, occurring in Costa Rica and Panama, are reviewed and in part redescribed. Five species are described as new: *Lithoscirtus tessellatus* sp. n., *Drymophilacris glyphiocerca* sp. n., *Drymophilacris nigrescens* sp. n., *Drymophilacris veraguensis* sp. n., and *Drymophilacris melanopsis* sp. n. The previously unknown female of *Drymacris panamae* (Descamps) is described, and the species restored to *Drymophilacris* on the basis of female characters, giving the reinstated combination *Drymophilacris panamae* Descamps; *Drymacris* is thereby left monospecific, and is redescribed. New data on the distribution and coloration in life of previously described species are presented. Keys to the three genera and to the species of *Lithoscirtus* and *Drymophilacris* are given.

Key-words: taxonomy - Neotropics - Central America - Orthoptera - Acrididae - Proctolabinae.

INTRODUCTION

The term "*Lithoscirtus* genus group" is used here for three closely related genera, *Lithoscirtus* Bruner, 1908, *Drymophilacris* Descamps, 1976 and *Drymacris* Descamps & Rowell, 1978, belonging to the subtribe Lithoscirtae of the tribe Proctolabini. Phylogenetic analysis of mitochondrial ribosomal DNA genes (Flook and Rowell, in preparation) confirm that the three genera are a clade and each others' nearest relatives. The first species to be described (Rehn, 1905) were erroneously placed by the author in the genus *Dellia*, which is not a proctolabine but possibly a primitive ommatolampine, and is restricted to the Greater Antilles. Later Rehn (1929) combined these and other newly described species with the genus name *Lithoscirtus* and characterised that genus for the first time, the name having been created by Bruner (1908) without documentation. The genus *Drymophilacris* was split from *Lithoscirtus* by Descamps (1976), based on the shape of the male cerci and of the anterior margin of the endophallic sclerites. Subsequently, Descamps & Rowell

(1978) further split off from *Drymphilacris* the genus *Drymacris*, on the basis of differences in the male and female cerci, the female subgenital plate, the ovipositor and the elytra.

To date there are 3 described species of *Lithoscirtus*, two of *Drymacris* and three of *Drymphilacris*, and the combined range of all three genera extends from northern Costa Rica to western Panama. Six of these are montane, but *D. bimaculata* and *L. viceitas* extend into the Caribbean lowlands. Early larvae of all three genera have a characteristic black coloration with an orange head and dorsal yellow stripe (Descamps & Rowell, 1978). The adult males are notable for the species-specific coloured patches, usually yellow or pale blue, on the subgenital and supraanal plates, which appear to serve in intraspecific communication (Rowell, 1983). All these species are small, flightless, brilliantly coloured grasshoppers of neotropical wet forest, especially of tree-fall clearings and forest edges, and all are foodplant specialists, eating a few species of Solanaceae and in a few cases (*Lithoscirtus minutulus*, *Drymphilacris nigrescens* sp. n.) some Asteraceae as well. The spatulate dorsal ovipositor valves are associated with the habit of laying eggs in foam sandwiched between leaves of the foodplant, and not in the ground.

In this paper I describe one new species of *Lithoscirtus* from Costa Rica and four new species of *Drymphilacris*, one from Costa Rica and three from Panama. All the new species are from montane forest of the Caribbean slope. Keys to these genera are given; their range is extended to Central Panama. The previously unknown female of *Drymacris panamae* Descamps is also described, and the species reassigned to *Drymphilacris*. Additional distributional and natural history records for the previously described species of the three genera are given.

Abbreviations of depositories: ANSP, Academy of Natural Sciences, Philadelphia, USA; INBio, Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica; MHNP, Museum National d'Histoire Naturelle, Paris, France; RC, the author's collection; UMMZ, University of Michigan Museum of Zoology, Ann Arbor, USA; UP, Museo de Invertebrados G.B. Fairchild, Universidad de Panamá, Panama.

CHARACTERS OF THE GENUS GROUP

The Lithoscirtae were recognized as a subtribe of the tribe Proctolabini by Amédégnato (1974, 1977), and this usage was continued by Descamps in his 1976 revision. Within the subtribe the *Lithoscirtus* genus group is separated from other genera by the incurved posterior edge to the pronotum and by its microptery (except for *Drymacris nebulicola* (Descamps, 1976)); also by the fact that the upper ovipositor valves are to a greater or lesser extent dorsoventrally flattened into spatula-like organs (e.g. Figs. 3A, 7A), which diverge distally (unlike the situation in *Tela* and *Paratela*, where the valves are also spatulate, but parallel). The fastigium is more or less produced, subtriangular in dorsal view, ending in a low ridge separating it from the flattened frontal ridge. The prosternal process is wide and low. The male supra-anal plate and the posterior rim of the 10th. abdominal tergite anterior to it are usually covered with long vertical white hairs with bent-over horizontal tips (e.g. Figs 1C, 4B).

The male internal genitalia were first described and figured by Descamps (1976). All the *Lithoscirtae* have a flat, shield-shaped epiphallus (rather than disc-shaped, the term used by Descamps), devoid of ancorae and with small lophi (e.g. Fig. 2A). In the entire subfamily the ventrolateral sclerites are elongate and fused together at both ends, and posterior to the cingulum are united dorsally by a more or less sclerotised membrane. The resultant structure resembles the soleless upper of a shoe (e.g., Figs 2B, 5B); the cingular apodemes and endophallic processes project from the opening for the "ankle", the "heel" encloses the endophallus anteriorly, and the "toe" overhangs the aedeagal valves. Amédégnato (1977) pointed out that in the *Lithoscirtae* and most other proctolabines the anterior apodemes of the endophallus are lost, and replaced by very similar-looking structures derived from flattened projections of the central zone of the endophallus. For this reason the term "processes" rather than "apodemes" is used here). The cingulum is rather small and weak; paired lobes of thin, densely ornamented membrane run posteriorly from the rami, sheathing the lower aedeagal valves ventrolaterally midway to their tip (e.g. Figs 2B; 5B & D). The anterior processes of the endophallus are large, compressed laterally and provided with wide semimembranous margins (e.g. Figs 2B, 5B). The dorsal aedeagal sclerites are thin and bound by the sheathing membrane into a single medial dorsal aedeagal valve (e.g. Figs 2D, 5B & D), lying between the lower valves. In the *Lithoscirtus* genus group (as in the genera *Tela* and *Paratela*) the ventral sclerites of the aedeagus have a laterally directed hook (or hooks) at the tip (e.g. Figs 2B, D & E; 5B & D).

KEY TO GENERA (external characters)

MALES

- 1 Cerci long, only slightly incurved, with an abrupt embayment in the ventral edge at 2/3 of the length, tip laterally flattened and symmetrically rounded. Elytra cycloid, extending into 2nd abdominal segment and partially covering tympana *Drymacris* Descamps & Rowell
- Cerci of various forms, but not as above. Elytra squamiform, extending maximally into metanotum 2
- 2 Cerci abruptly flexed inwards by some 70° at about half length, completely or almost completely melanized; furcula absent (Fig. 1B-D) *Lithoscirtus* Bruner
- Cerci curved smoothly inwards, forceps-like, usually only the distal region melanized; furcula absent or present (Figs. 4, 8, 11, 14 & 16, B-D in all cases) *Drymophilacris* Descamps

FEMALES

- 1 Elytra cycloid, extending into 2nd abdominal segment and partially covering tympana. Cerci short, with blunt rounded tips (Fig. 19A, D). Dorsal ovipositor valves slightly excavated on dorsal surface, with raised internal edge (Fig. 19A, D). Subgenital plate flat (Fig. 19C) *Drymacris* Descamps & Rowell

- Elytra squamiform, extending maximally into metanotum. Dorsal ovipositor valves flattened, spatulate. Cerci long and straight, with fine sharp points (Figs 3A, 7A, 10A, 13A, 18A). Subgenital plate domed or with paired swellings at anterior margin 2
- 2 Subgenital plate smoothly domed in anterior region (Fig. 3C).
..... *Lithoscirtus* Bruner
- Subgenital plate with paired ventral or ventrolateral swellings near anterior margin (Figs 7B & C, 10B & C, 13B & C, 18B & C)
..... *Drymphilacris* Descamps

Lithoscirtus Bruner, 1908

Bruner, 1908: 273. Type species: *Dellia miniatula* Rehn, 1905: 423. Rehn, 1929: 14. Amédégnato, 1974: 200. Descamps, 1976: 68, 77-80 (revision of genus). Amédégnato, 1977: 256. Amédégnato & Poulain, 1987: 400.

Medium-small grasshoppers (>9.9, <20 mm in length); body size 14-17 mm (males), 17-19 mm (females). Hind femur 3.8-3.9X as long as pronotum, 0.20-0.23X as deep as long. Hind foot 0.39-0.46X as long as femur, second tarsal joint makes up 0.22-0.24 of foot. Interocular space narrow, 0.36-0.48X (males), 0.58-0.64X (females) as wide as antennal pedicel. Antennae long and filiform, 4.5-4.9 (males), 3.3-3.7X (females) as long as pronotum. Micropterous; elytra extend maximally to the anterior part of the metanotum. The thickened transverse ridge typically separating the fastigium from the frontal ridge in the Proctolabinae is obsolete in this genus (Descamps, 1976).

Male characters. Male cerci short, thick, inwardly flexed at their tip, typically heavily melanized throughout (that of *L. tessellatus* sp. n. has however a green outer face proximally). Epiphallus (Fig. 2A) subrectangular, as long or longer than its greatest width, widening posteriorly towards the lophi, which are more erect than in *Drymphilacris*. The anterior processes of the endophallic sclerites are remarkable and diagnostic of the genus, being large thin irregular crumpled sheets of chitin, resembling miniature cabbage leaves (see Figs 2B-D). Ventral sclerites of the aedeagus rather short, dorsoventrally flattened, wide proximally in ventral view, tapering to the tip, ending in recurved hooks (Fig. 2B-E).

Female characters (Fig. 3). Cerci straight, tapering to a fine point (as in *Drymphilacris*). Subgenital plate simple, triangular, but with concave posterior edges; the anterior region smooth and domed, without paired swellings. Posterior extremity of subgenital plate ("egg-guide") short, straight, laterally compressed and bluntly pointed in lateral view, about half as long as the visible portion of the ventral valves of ovipositor. Bursa copulatrix rather short and thin-walled relative to the other two genera. Lateral diverticulum of spermatheca with an initial wide chamber followed by a thinner, rather simply convoluted appendage without secondary diverticula.

KEY TO SPECIES OF *LITHOSCIRTUS* (males)

Males of this genus are traditionally separated on the complex shapes of the cerci (see Figs in Rehn, 1929 & Descamps, 1976, and Fig. 1 of this paper), which is undoubtedly the best method when dealing with museum specimens, but requires a microscope. The key given below is based on the colour differences of living animals, which are unambiguous for all except the two very similar species *miniatus* and *viceitas*. These latter however are nowhere sympatric and when alive differ markedly in ground colour (though not when dried). Females are best identified by association with their males, to which they are similarly coloured; all females and no males have white-tipped antennae. A rarer bronze-coloured female morph exists in all species.

- 1 Apex of subgenital plate entirely black without other markings. Body generally black, but with dark green iridescence in life; paired dorsoventral spots at posterior margin of pronotum whitish yellow (not green, as in other spp.). All legs green. Cercus in side view vertically truncate at tip. *L. daedalus* Rehn, 1929, southern (nominate) race.
- Not as above. 2
- 2 Apex of subgenital plate with paired coloured spots. Elytron extends into metanotum. 3
- Apex of subgenital plate with an undivided pale blue medial patch (or a pair of medially confluent ones); femora of mesothoracic legs red, other legs green. Elytron does not reach posterior border of mesonotum. 4
- 3 Apex of subgenital plate with paired pale blue patches. Fastigium and vertex markings, metallic blue green; femora of mesothoracic legs, red. Cercus in side view vertically truncate at tip. *L. daedalus* Rehn, 1929, northern race (cf. Descamps & Rowell, 1984).
- Apex of subgenital plate with paired dull green patches (Fig. 1B). Legs all green. Cercus in side view (Fig. 1C) tapering to a blunt, upwardly inflected tip, with a grey-green area near the base. Antennae black proximally and in distal half, but pale green in segments 2-7 (Fig. 1A). *L. tessellatus* sp. n.
- 4 Colour in life principally metallic green. Cercus in side view obliquely truncate at tip (N.E. Costa Rica). *L. miniatus* (Rehn, 1905)
- Colour in life principally metallic blue. Cercus in side view tapering to a point (S.E. Costa Rica, N. Panama). *L. viceitas* Rehn, 1929

1. *Lithoscirtus miniatus* (Rehn, 1905)

Dellia miniatula Rehn, 1905: 423. Bruner, 1908: 273. Kirby, 1910: 423.

Lithoscirtus miniatus Rehn, 1929: 19. Descamps, 1976: 77. Amédégnato, 1977: Figs 364-366.

Holotype male: COSTA RICA: Prov. S. José: Carrillo, June 1903 (J.A.G. Rehn) (ANSP).

Dimensions: see Table 1.

Distribution: NE Caribbean slope of Costa Rica from at least 1700 m down to about 300 m altitude. The species is typical of montane forest and does not occur in true lowland rain forest, where it is replaced ecologically by *Drymophilacris bimaculata*. As noted by Rehn (1929), Bruner's locality of Pozo Azul (on the Pacific slope) is almost certainly false. Rehn listed specimens from Carrillo, Juan Viñas, and Guápiles. Other specimens have now been taken from the Sarapiquí valley at Cinchona, La Virgen del Socorro and Chilamate (Provinces of Heredia and Alajuela); from the ridge between the Río Peje and the Río Sardinalito (Prov. Heredia); from Cerro Zurquí through the entire P.N. Braulio-Carrillo to Carrillo itself, and from the region around S. Jerónimo, Alto la Palma and Bajo la Hondura (Prov. S. José); along the upper reaches of the Río Toro Amarillo (Prov. S. José) down to Guápiles, and from near Tucurrique (Prov. Limón); and from Turrialba and Chitaria (Prov. Cartago).

This species is usually found on selected species of *Solanum* and *Witheringia*, but also occurs on *Datura* and (more rarely) on *Verbesina* and *Vernonia* spp. (Asteraceae).

2. *Lithoscirtus viceitas* Rehn, 1929

Rehn, 1929: 20. Descamps, 1976: 78.

Holotype male: COSTA RICA: Prov. Limón: Suretka trail, between the Sixaola and Estrella Valleys, 19 May 1924 (Bradley JC) (ANSP).

Dimensions: see Table 1. Apart from the ground colour when alive (see Key) and the form of the male cerci, almost indistinguishable from *L. miniatulus*. The pregenicular part of the hind femur is thicker in *viceitas*, as noted by Rehn (1929), but the difference is only 0.05 mm and requires simultaneous comparison of the two species to be seen.

Distribution: mid-elevation and lowland forest of the Caribbean slope, from the city of Limón (Costa Rica) south and east at least to Colón in Panama. The most widely distributed species of the genus, in many areas sympatric with one of several species of *Drymophilacris*.

Rehn's (1929) localities were from the Suretka trail (Prov. Limón) and the Ujarrás de Terraba (Prov. Cartago), both in montane forest in SE Costa Rica. It has since been found along the valley of the Río Pacuare down to near Turrialba (Prov. Cartago), and throughout the valleys of the Río Bananito, of the rivers of the Valle de la Estrella and of the Río Sixaola almost to sea level (Prov. Limón). In Panama it has been recorded from Prov. Bocas del Toro (Changuinola, Guabita, and above Chiriquí Grande), Prov. Coclé (Cerro Copé; El Valle de Antón, Cerro Gaitál), Prov. Panama (Cerro Campana) and Prov. Colón (Colón; Gatún; Porto Bello). The Panamanian localities range from 1100 to 20 m altitude.

A strict specialist on a few species of Solanaceae.

TABLE 1. Dimensions of *Lithoscirtus* spp. and *Drymacris*

	<i>Lithoscirtus daedalus</i>		<i>L. miniatulus</i>		<i>L. vicellus</i>		<i>L. tessellatus</i>		<i>Drymacris nebulicola</i>	
MALES	MEAN		MEAN		MEAN		MEAN		MEAN	
Dimensions in millimetres:	N = 5		N = 3		N = 3		N = 3		N = 3	
F: Hind femur, length	8.90 - 9.15	(9.06)	10.30 - 9.33	(9.74)	8.07 - 10.20	(9.49)	10.03 - 10.58	(10.31)	10.40 - 11.44	(10.84)
FD: Hind femur, depth	1.93 - 2.08	(2.00)	2.13 - 1.98	(2.04)	1.72 - 2.15	(1.98)	1.96 - 2.16	(2.07)	1.97 - 2.07	(2.02)
L: Rostrum-subgen. plate	14.64 - 14.72	(14.68)	15.79 - 14.94	(15.26)	12.32 - 16.98	(14.74)	16.14 - 18.04	(16.91)	15.06 - 15.78	(15.47)
P: Pronotum (midline)	2.36 - 2.45	(2.39)	2.61 - 2.49	(2.55)	2.05 - 2.72	(2.47)	2.59 - 2.72	(2.65)	3.01 - 3.23	(3.13)
Interocular space	0.15 - 0.17	(0.16)	0.16 - 0.14	(0.15)	0.16 - 0.16	(0.16)	0.18 - 0.21	(0.20)	0.15 - 0.19	(0.17)
EE: (eye-eye)	3.13 - 3.24	(3.18)	3.23 - 3.13	(3.19)	2.84 - 3.36	(3.17)	3.19 - 3.36	(3.28)	3.40 - 3.43	(3.42)
Fastigium	0.38 - 0.52	(0.44)	0.49 - 0.34	(0.42)	0.38 - 0.40	(0.39)	0.40 - 0.51	(0.44)	0.51 - 0.56	(0.54)
Antennal pedicel (width)	0.39 - 0.44	(0.41)	0.41 - 0.40	(0.41)	0.37 - 0.41	(0.39)	0.39 - 0.42	(0.41)	0.46 - 0.50	(0.48)
Antenna	10.14 - 11.43	(10.84)	13.37 - 11.61	(12.47)	10.30 - 13.40	(12.12)	11.16 - 12.65	(12.11)	11.60 - 13.07	(12.38)
T1: hind tarsus 1	1.09 - 1.17	(1.13)	1.41 - 1.13	(1.26)	1.00 - 1.28	(1.16)	1.33 - 1.34	(1.33)	1.57 - 1.74	(1.64)
T2: hind tarsus 2	0.86 - 0.92	(0.89)	0.93 - 0.87	(0.91)	0.76 - 0.84	(0.80)	1.09 - 1.215	(1.12)	1.35 - 1.47	(1.43)
T3: hind tarsus 3	1.56 - 1.73	(1.64)	2.12 - 1.86	(1.96)	1.49 - 1.82	(1.69)	2.26 - 2.32	(2.29)	2.18 - 2.47	(2.33)
Ratios										
FD/F	0.21 - 0.23	(0.22)	0.22 - 0.21	(0.21)	0.20 - 0.21	(0.21)	0.20 - 0.21	(0.20)	0.18 - 0.19	(0.19)
F/P	3.73 - 3.88	(3.79)	3.95 - 3.75	(3.82)	3.75 - 3.94	(3.85)	3.69 - 4.01	(3.89)	3.31 - 3.54	(3.47)
L/P	5.98 - 6.24	(6.14)	6.19 - 5.76	(5.98)	5.66 - 6.24	(5.97)	6.11 - 6.63	(6.38)	4.80 - 5.24	(4.95)
Interoc./P	0.06 - 0.07	(0.07)	0.06 - 0.05	(0.06)	0.06 - 0.08	(0.07)	0.07 - 0.08	(0.07)	0.05 - 0.06	(0.05)
Interocular/pedicel	0.38 - 0.43	(0.40)	0.39 - 0.34	(0.36)	0.39 - 0.43	(0.41)	0.43 - 0.54	(0.48)	0.30 - 0.41	(0.36)
Fast/EE	0.12 - 0.17	(0.14)	0.15 - 0.11	(0.13)	0.12 - 0.14	(0.13)	0.12 - 0.15	(0.13)	0.15 - 0.16	(0.16)
(T1 + T2 + T3)/F	0.40 - 0.42	(0.40)	0.43 - 0.42	(0.42)	0.37 - 0.40	(0.39)	0.45 - 0.47	(0.46)	0.49 - 0.50	(0.50)
T2/ (T1+T2+T3)	0.24 - 0.25	(0.24)	0.43 - 0.42	(0.22)	0.21 - 0.23	(0.22)	0.23 - 0.24	(0.24)	0.26 - 0.27	(0.27)
Ant/Pronotum	4.28 - 4.67	(4.53)	0.23 - 0.21	(4.89)	4.80 - 5.02	(4.92)	4.10 - 4.83	(4.57)	3.59 - 4.34	(3.97)
EE/F	0.34 - 0.36	(0.35)	5.12 - 4.55	(0.33)	0.32 - 0.35	(0.33)	0.32 - 0.32	(0.32)	0.30 - 0.33	(0.32)
FEMALES										
Dimensions in millimetres:	MEAN		MEAN		MEAN		MEAN		MEAN	
	N = 3		N = 3		N = 3		N = 2		N = 3	
F: Hind femur, length	10.73 - 10.93	(10.83)	11.03 - 10.20	(10.75)	8.56 - 10.82	(9.88)	11.10 - 12.11	(11.61)	11.59 - 12.36	(12.00)
FD: Hind femur, depth	2.27 - 2.47	(2.39)	2.35 - 2.21	(2.27)	1.97 - 2.42	(2.25)	2.26 - 2.40	(2.33)	2.41 - 2.46	(2.43)
L: Rostrumsubgen. plate	16.74 - 18.58	(17.88)	17.38 - 18.28	(18.69)	14.30 - 18.63	(16.81)	17.86 - 19.39	(18.63)	19.46 - 19.27	(18.86)
P: Pronotum (midline)	2.81 - 2.90	(2.85)	2.88 - 2.84	(2.86)	2.44 - 3.07	(2.74)	2.74 - 3.14	(2.94)	3.61 - 3.78	(3.68)
Interocular space	0.21 - 0.23	(0.22)	0.24 - 0.21	(0.23)	0.21 - 0.25	(0.24)	0.29 - 0.32	(0.31)	0.26 - 0.28	(0.27)
EE: (eye-eye)	3.51 - 3.54	(3.52)	3.50 - 3.34	(3.40)	2.97 - 3.47	(3.28)	3.55 - 3.57	(3.56)	3.41 - 3.61	(3.54)
Fastigium	0.43 - 0.56	(0.50)	0.46 - 0.40	(0.42)	0.41 - 0.52	(0.45)	0.46 - 0.48	(0.47)	0.54 - 0.65	(0.60)
Antennal pedicel (width)	0.37 - 0.39	(0.38)	0.40 - 0.36	(0.38)	0.32 - 0.36	(0.34)	0.35 - 0.40	(0.38)	0.39 - 0.46	(0.42)
Antenna	9.43 - 9.47	(9.45)	10.00 - 9.67	(9.83)	7.89 - 12.40	(10.01)	10.15 - 10.27	(10.21)	11 - 11.87	(11.40)
T1: hind tarsus 1	1.42 - 1.51	(1.47)	1.38 - 1.33	(1.35)	1.04 - 1.46	(1.30)	1.49 - 1.54	(1.52)	1.69 - 1.79	(1.75)
T2: hind tarsus 2	0.98 - 1.01	(1.00)	1.10 - 0.97	(1.04)	0.71 - 1.00	(0.87)	1.20 - 1.30	(1.25)	1.42 - 1.56	(1.50)
T3: hind tarsus 3	2.07 - 2.13	(2.10)	2.26 - 1.85	(2.10)	1.56 - 1.94	(1.80)	2.41 - 2.60	(2.51)	2.31 - 2.63	(2.49)
Ratios										
FD/F	0.21 - 0.23	(0.22)	0.22 - 0.20	(0.21)	0.22 - 0.23	(0.23)	0.20 - 0.20	(0.20)	0.19 - 0.21	(0.20)
F/P	3.77 - 3.85	(3.80)	3.86 - 3.59	(3.76)	3.51 - 3.80	(3.61)	3.86 - 4.05	(3.95)	3.19 - 3.38	(3.26)
L/P	5.80 - 6.54	(6.10)	6.03 - 5.69	(5.83)	5.86 - 6.48	(6.14)	6.18 - 6.52	(6.35)	4.88 - 5.27	(5.12)
Interoc./P	0.07 - 0.08	(0.08)	0.08 - 0.07	(0.08)	0.08 - 0.09	(0.09)	0.09 - 0.12	(0.10)	0.07 - 0.08	(0.07)
Interocular/pedicel	0.54 - 0.61	(0.58)	0.67 - 0.53	(0.59)	0.66 - 0.76	(0.70)	0.73 - 0.01	(0.82)	0.61 - 0.72	(0.65)
Fast/EE	0.12 - 0.16	(0.14)	0.14 - 0.12	(0.12)	0.12 - 0.15	(0.14)	0.13 - 0.13	(0.13)	0.15 - 0.18	(0.17)
(T1+T2+T3)/F	0.42 - 0.43	(0.42)	0.43 - 0.41	(0.42)	0.38 - 0.41	(0.40)	0.76 - 0.83	(0.80)	0.47 - 0.50	(0.48)
T2/ (T1+T2+T3)	0.21 - 0.22	(0.22)	0.23 - 0.23	(0.23)	0.21 - 0.23	(0.22)	0.24 - 0.24	(0.24)	0.26 - 0.26	(0.26)
Ant/Pronotum	3.26 - 3.37	(3.32)	3.47 - 3.38	(3.44)	3.23 - 4.04	(3.63)	3.23 - 3.75	(3.49)	3.04 - 3.14	(3.09)
EE/F	0.32 - 0.33	(0.33)	0.33 - 0.30	(0.32)	0.32 - 0.35	(0.33)	0.29 - 0.32	(0.31)	0.28 - 0.31	(0.30)

3. *Lithoscirtus daedalus* Rehn, 1929

Rehn, 1929: 22. Descamps & Rowell, 1984: 155.

Holotype male: COSTA RICA: Prov. Cartago; Navarro, 3800-3950 m, 24. July 1927 (Lankester CH. Rehn JAG) (ANSP).

Dimensions: see Table 1.

This Costa Rican species occurs in two distinct colour forms which are geographically separated (Descamps & Rowell, 1984). It is apparently confined to the upper reaches (above 1000 m altitude) of the Río Reventazón and its tributaries.

A strict specialist on a few species of Solanaceae.

The ranges of the three preceding species adjoin each other in the neighbourhood of Turrialba. Nowhere are they known to be sympatric.

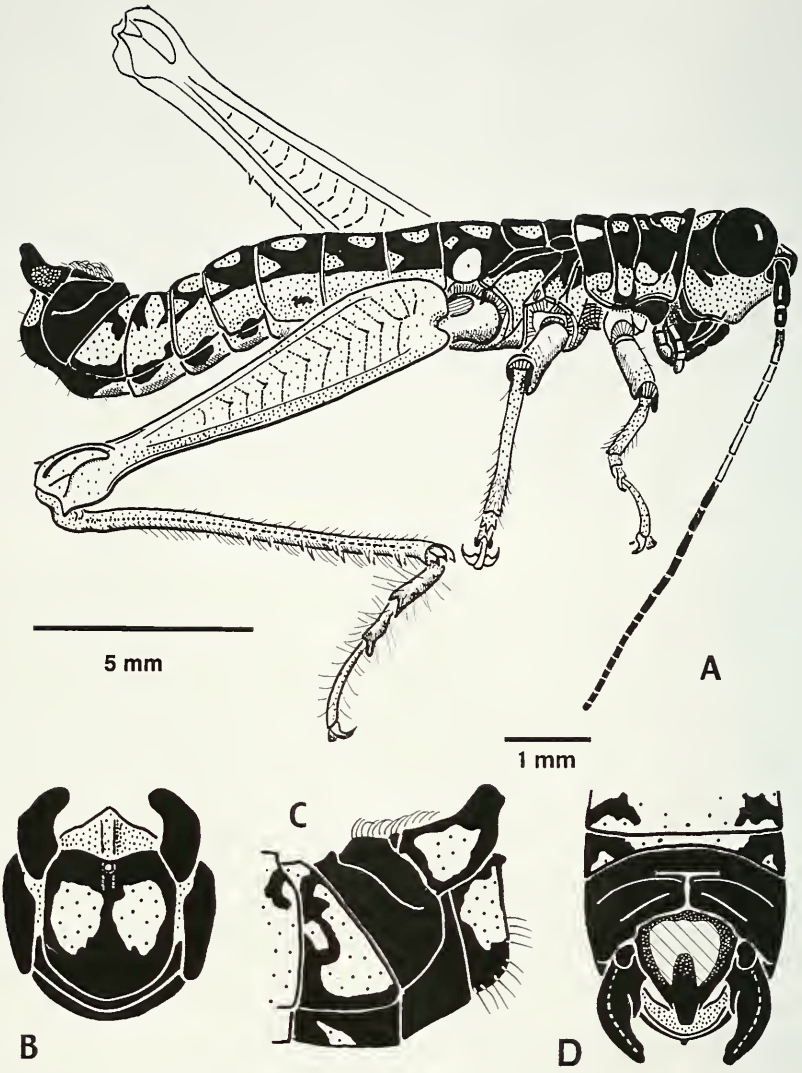


FIG. 1

Lithoscirtus tessellatus sp. n., male. A, Habitus. B-C, external genital region, in axial, lateral and dorsal views.

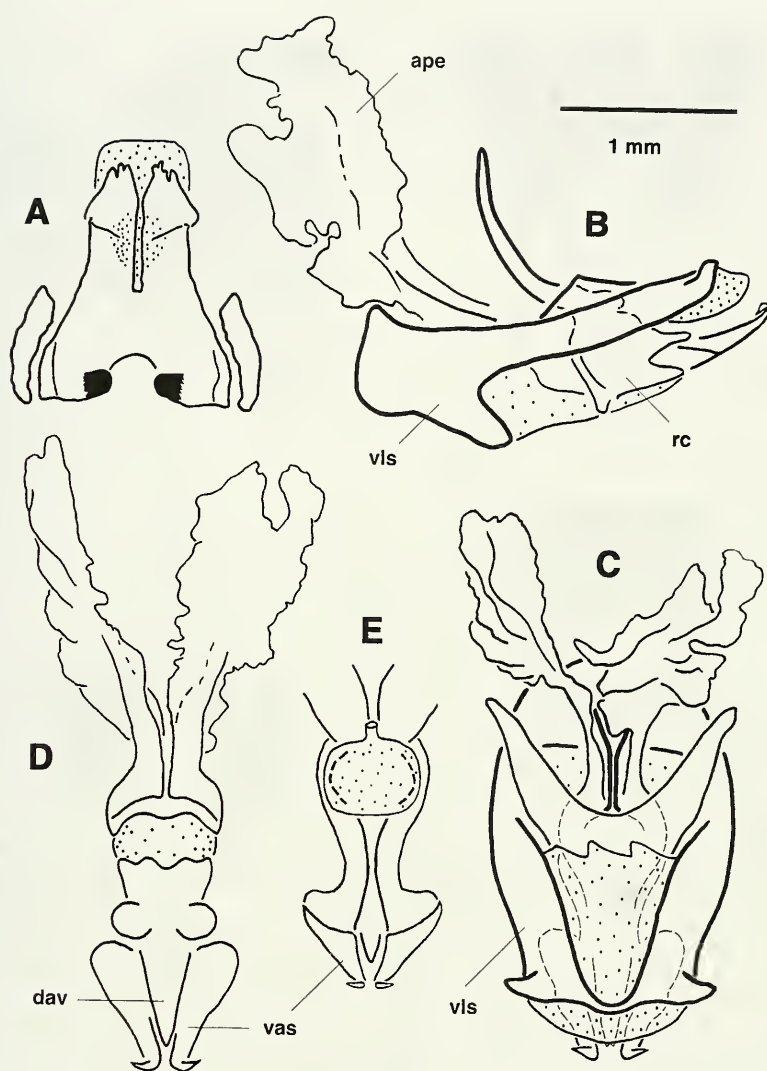


FIG. 2

Lithoscirtus tessellatus sp. n., male. Internal genitalia. A, epiphallus. B, C, phallic complex in lateral and dorsal views. D, E, endophallus in dorsal and ventral views. Abbreviations: ape, anterior process of endophallus; dav, dorsal aedeagal valve; rc, rami of cingulum and associated membranes; vas, ventral aedeagal sclerite; vls, ventrolateral sclerite.

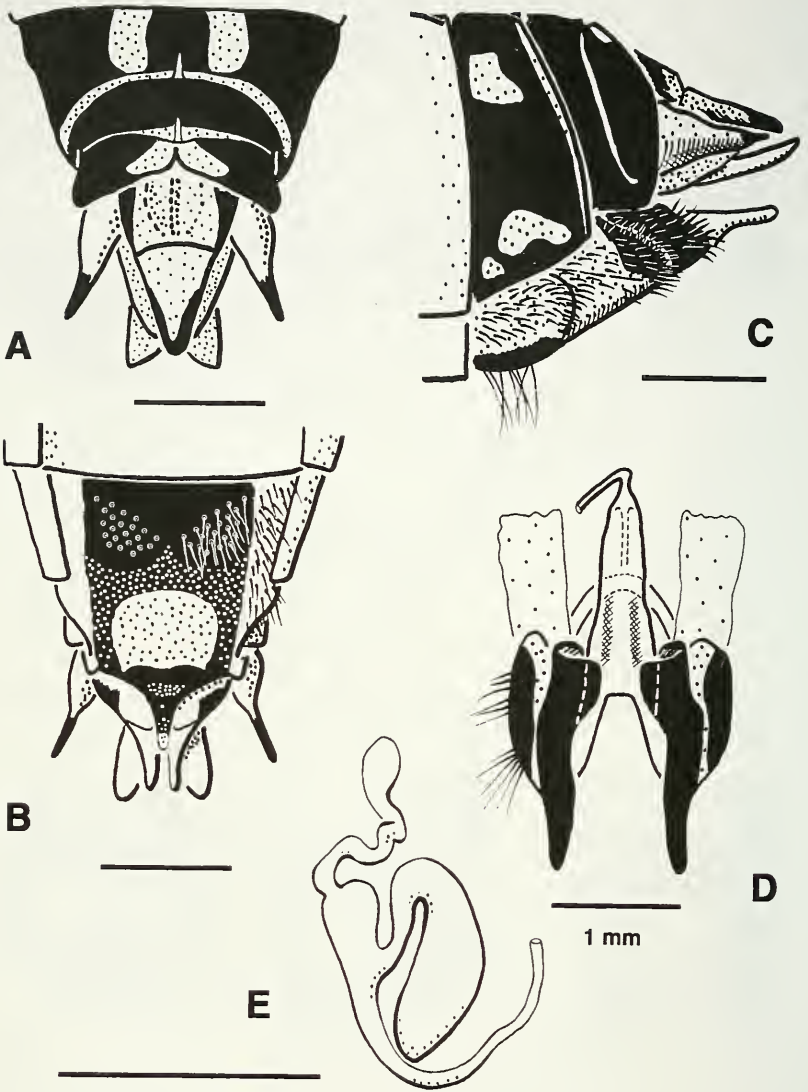


FIG. 3.

Lithoscirtus tessellatus sp. n., female. A-C, external genital region in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

4. *Lithoscirtus tessellatus* sp. n.

Holotype male: COSTA RICA: Guanacaste Prov.: Volcan Tenorio: nr. summit of rd. from Tierras Morenas to Bajo Los Cartagos. 1040 m, LN287250_426500, 21 July 1991 (Rowell CHF & Elsner N), specimen no. 91108. Allotype female: same data as holotype, specimen no. 91109 (both ANSP). Paratypes: As holotype, male, specimen no. 91107 (RC). Guanacaste Prov.: Tilarán, Zona Protectora Tenorio A.C.A., Río San Lorenzo, 1050 m, LN287800_427600, May 1994 (G. Rodriguez), specimen nos. CRI001 873901 (male), CRI001 873902 (female); (INBio).

Etymology: Latin *tessellatus*, inlaid with square mosaic stones, referring to the pattern of green and black markings.

MALE (Fig. 1). Elytron squamiform, large for the genus, reaching to anterior margin of metanotum. Wing absent. Cerci (Fig. 1B-D) short, bent abruptly inwards halfway to tip at 45°, tip rounded, concavely excavated on ventral edge. Subgenital plate (Fig. 1B-D) with a short round tubercle medially and apically, at the junction of the plate and the pallium. Furcula absent. Supra-anal plate (Fig. 1D) longer than wide, ending in a blunt-tipped medial process.

Internal genitalia (Fig. 2) generally typical of the genus. The hooks at the tips of the ventral valves are more robust and less curved than in the other species.

Coloration: Antennae: scape, pedicel and first flagellar segment, glossy black; flagellar segments 2-7, pale green, 8 to 21 (tip), dull black. Eyes black (brown when dried). Palps green; mandibles, labrum and clypeus, glossy black. Rest of head basically green; inverted V on vertex, post-ocular stripe, ventral rim of frons, ventral and posterior rim of genae, antennal sockets, rostrum, and an hourglass-shaped mark on frontal ridge, with narrowest point ventral to the medial ocellus: glossy black.

Disc of pronotum, glossy black. A pair of dorsolateral green spots in front of each sulcus, and a pair of yellow spots behind the third sulcus, reaching the hind margin. Lateral lobes glossy black, blotched with green ventrally, proepimeron black. Mesonotum black. Elytron, black, dorsal margin green-brown. Mesonotum black with central green blotch and paired yellow spots dorsolaterally at hind margin. Meso- and metepimera and episterna black dorsally, green ventrally.

Front and middle legs yellow proximally, shading to green by the middle of the femur, each with 4 brown tibial spines. Claws and pulvilli black. Hind femur green, hind tarsus green proximally, blue-green distally, tibial spines (7 externally, 8 internally) and spurs brown, tipped black. Tarsi green, claws and pulvillus brown, tipped black.

Abdominal segments with same pattern as metanotum, but with paired medial green marks, increasing in relative size towards the distal segments. Underside black, with a pale posterior rim to each segment. Genital region black. Supraanal plate (Fig. 1D) lemon yellow, bordered black, covered thinly with long white hairs. Cerci (Fig. 1B-D) mostly black but greenish proximally on outer surface. Subgenital plate (Fig. 1B, C) black, with paired green spots.

FEMALE. Elytron squamiform, overlapping anterior margin of metanotum. Supra-anal plate (Fig. 3A) triangular, longer than wide, tip rounded, almost as long as

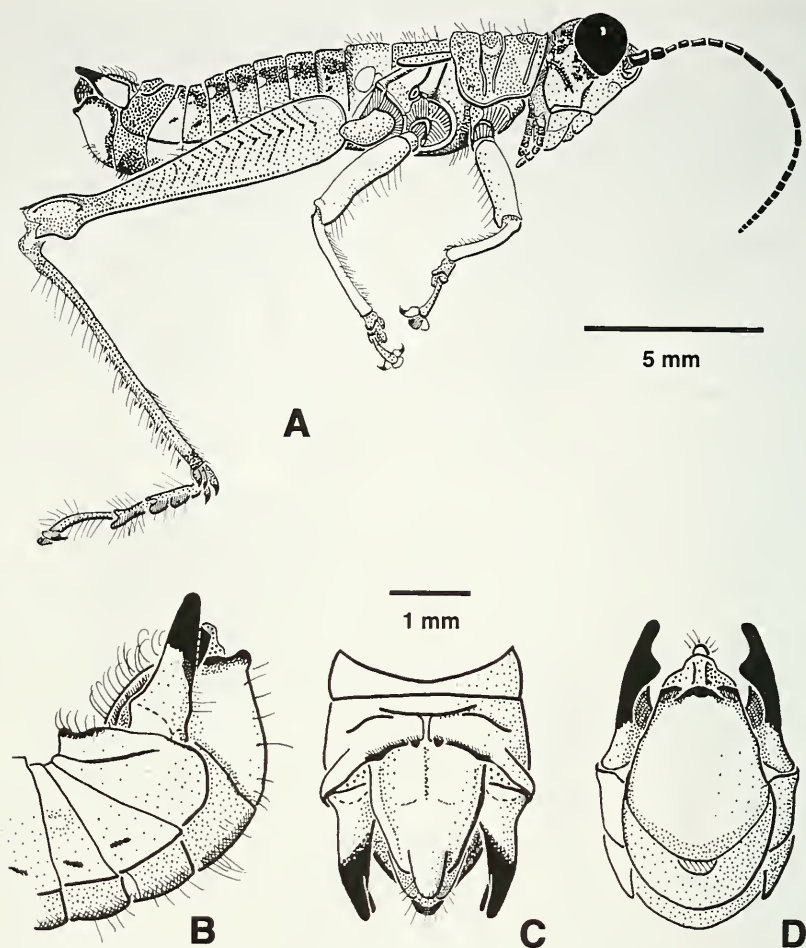


FIG. 4

Drymophilacris panamae Descamps, male. A. habitus. B-D, external genitalia in lateral, dorsal and ventral views.

dorsal ovipositor valves, transversely divided, with a shallow medial depression proximally. Subgenital plate (Fig. 3B, C) melanized in medial region, smoothly domed anteriorly, with paired patches of long hairs (in the position of the swellings of *Drymophilacris*), flat posteriorly, with a central semi-membranous area, posterior edges concave, apex ("egg-guide") short, not more than half the length of the ventral valves in ventral view; lateral lobes densely hairy.

Internal genitalia (Fig. 3D, E). Typical of genus (see above). Basal external shoulder of ventral ovipositor valves sclerotized and provided with long lateral hairs.

Coloration other than in antennal and genital regions as in male, but markings somewhat less clearly defined and colours less brilliant. Antennae black, terminal 2 segments white, the preceding one reddish brown. Supraanal plate olive green, shading to olive brown, blackish at tip. Ovipositor valves, brown-black; dorsal face of upper valves, green. Subgenital plate blackish-brown, lateral lobes green.

Dimensions: see Table 1. *L. tessellatus* is the largest species of the genus to date; its proportions, however, are normal.

This species appears to be more closely related to *L. daedalus* than to the *miniatus/viceitas* complex. The former has a trace of the protuberance at the apex of the dorsal edge of the male subgenital plate, seen in *tessellatus*, as well as the longer elytra.

Natural History. On Solanaceae in clearings and at edges of mid-altitude montane forest in the Tilarán area. At first sight looks like a small example of *Dryophilacris montevertensis*, which has a very similar coloration and is geographically close. Males are however readily distinguished by the subgenital plate with its twin small green spots, that of *D. montevertensis* is entirely pale turquoise blue. The pale proximal third of the male antenna is also distinctive; those of *D. montevertensis* are entirely black.

Dryophilacris Descamps, 1976

Descamps, 1976: 80. Type species: *Dellia bimaculata* Rehn, 1905: 426. Amédégnato, 1977: 256. Descamps & Rowell, 1978: 358. Amédégnato & Poulain, 1987: 400.

Medium-small (>10, <20 mm) to medium (>20, <30 mm) sized grasshoppers: body length 14–19 mm (males), 17–22 mm (females). Hind femur 3.5–4.0X as long as pronotum, 0.20–0.24X as deep as long. Hind foot 0.42–0.48X as long as femur, second tarsal joint makes up 0.21–0.25 of foot. Interocular space narrow but somewhat wider than that of *Lithoscirtus*, 0.48–0.52X (males), 0.69–0.82X (females) as wide as antennal pedicel. Antennae 3.7–4.8X (males), 2.5–3.5X (females) as long as pronotum, thus tending to be slightly shorter than those of *Lithoscirtus*. Micropterous, elytra do not exceed posterior border of metanotum (*D. panamae*), and are still smaller in the remaining spp.

Male characters. Cerci long, gradually curving inwards, forceps-like, nearly straight or somewhat sigmoid in lateral view, with tips of variable shape. Rim of subgenital plate pinched together at apex and prolonged medially, like the lip of a jug. Endophallus has large regularly oval anterior processes, with doubly flanged margins, sharply differentiating the genus from *Lithoscirtus*. Ventral aedeagal sclerites thin and tapering in both lateral and ventral view, ending in one or more sets of recurved hooks. Epiphallus usually relatively broader than that of *Lithoscirtus*, nearer square than rectangular in dorsal view, less narrowed anteriorly, lophi less erect.

Female characters. Cerci long and slender at tip, acutely pointed, similar to those of *Lithoscirtus*. Upper ovipositor valve flattened dorsoventrally, upper face flat (as in *Lithoscirtus*). Subgenital plate simple, triangular, posterior edges almost

straight, with 2 more or less prominent swellings near anterior margin; in some species these form large laterally projecting bulges visible from above. Apex of subgenital plate ("egg-guide") of variable length, from short in *D. bimaculata* to equalling the ventral ovipositor valves in *D. rubripes* and *D. nigrescens*; tip upturned, straight or downturned in lateral view. Spermatheca similar to *Lithoscirtus*, but with a more complex appendage of the lateral diverticulum, usually provided with pouches and small diverticula (but simple in *D. bimaculata*).

KEY TO SPECIES OF *DRYMOPHILACRIS* (adult males)

- 1 Subgenital plate black with a pair of yellow spots. Hind knees wholly or partly reddish brown. 2
- Subgenital plate not as above. 4
- 2 Clypeus, labrum, frontal ridge, frons, genae: yellow, lightly mottled with small black markings. Antenna in dorsal view black, minutely ringed with white at joints, terminal segment white. Furcula absent (Caribbean Costa Rica). *D. bimaculata* (Rehn, 1905)
- Face not as above; at least clypeus, labrum and antennal sockets black. Furcula present. 3
- 3 Frontal ridge, frons and ventral part of genae entirely black; terminal two segments of antennae white; furcula well-developed (Fig. 16) (Coclé Prov., Panama). *D. melanopsis* sp. n.
- Frontal ridge black only in dorsal region; remainder of frons and genae, yellow; spots of subgenital plate relatively small, covering only about half of total area; furcula small (Fig. 14) (Veraguas Prov., Panama). *D. veraguensis* sp. n.
- 4 Cercus with ventral distal extremity angled obliquely inwards and shorter than dorsal extremity (Figs 4 & 8). 5
- Cercus not as above. 6
- 5 Subgenital plate black with broadly confluent green spots; supra-anal plate yellow-green; hind knees red; antennae black with indistinct pale annulations proximally; furcula absent (Fig. 8) (highlands of Central Costa Rica). *D. glyphocerca* sp. n.
- Subgenital plate entirely pale blue, supra-anal plate yellow brown; all femora light reddish brown; furcula present but minute (Fig. 4) (highlands of SW Costa Rica and SW Panama). *D. panamae* Descamps, 1976
- 6 Cercus long and nearly parallel-sided in lateral view, almost completely black; subgenital plate entirely turquoise, supra-anal plate emerald green in life, yellow green when dried; furcula absent (Cordillera del Norte, Costa Rica). *D. montevertensis* Desc. & Rowell, 1978
- Cercus not as above; subgenital plate with confluent or narrowly separated blue-grey spots; furcula small but present. 7
- 7 Supra-anal plate blue-grey; femora of middle legs red basally, blue distally; pronotum mostly green (lowlands, Bocas del Toro, Panama). *D. rubripes* Desc. & Rowell, 1984

- Supra-anal plate yellow; femora of middle legs yellow basally, green distally; pronotum mostly black (Fig. 11) (highlands, Bocas del Toro, Panama). *D. nigrescens* sp. n.

5. *Drymphilacris bimaculata* (Rehn, 1905)

Dellia bimaculata Rehn, 1905: 426. Bruner, 1908: 272.

Lithoscirtus bimaculatus Rehn, 1929: 26.

Drymphilacris bimaculata Descamps, 1976: 81. Amédégnato, 1977: 256, Fig. 346. Descamps & Rowell, 1978: 359. Rowell, 1983: 714.

Holotype male: COSTA RICA: Prov. S. José: Carrillo, June 1903 (ANSP).

The species differs from all others in the noticeably upturned tip to the dorsal aedeagal valve, as illustrated in Descamps (1976). The recurved tips of the ventral valves are also proportionately longer than in other species.

Dimensions, see Table 2.

A specialist on species of *Solanum* and *Witheringia*.

Distribution. As indicated by Descamps & Rowell (1978), the species is widely distributed on the Caribbean slope of Costa Rica, from sea level to over 1000 m. It does not however seem to extend south of the Valle de la Estrella; though recorded from Puerto Viejo on the coast, it is absent from the valley of the R. Sixaola and in the adjoining area of Panama is replaced by *D. rubripes*. Its possible occurrence in the lowlands of Nicaragua is undocumented.

6. *Drymphilacris montevertensis* Descamps & Rowell, 1978

Descamps & Rowell, 1978: 358.

Holotype male: COSTA RICA: Prov. Puntarenas: Monteverde, 1400 m, LN 253500_448400, 10. Sept. 1975 (Rowell CHF) (MHNP).

New material examined: COSTA RICA: Prov. Guanacaste: W side of Volcán Cacao, Estac. Mengo, 1400 m, LN 323700_376700, 11 July 1988 (Janzen D. Hallwachs W). specimen no. CRI001 013274, and other later specimens from same locality (INBio).

Dimensions, see Table 2.

A specialist on species of *Solanum* and *Lycium*.

Previously recorded only from the region around the type locality, this species is now also known in a particularly large and robust form from Volcán Cacao, some 95 km to the NW.

7. *Drymphilacris rubripes* Descamps & Rowell, 1984

Descamps & Rowell, 1984: 154.

Holotype male: PANAMA: Prov. Bocas del Toro: Changuinola District, United Fruit Co. Plantation, 3. Oct. 1925 (Walker FW) (UMMZ).

New material examined: PANAMA: Prov. Bocas del Toro: Parque Internacional La Amistad, WEKSO-Region Teribé, 20.10.99 (DeGrazia L & Santos A). specimen nos. 99502 & 99503 (UP).

Dimensions, see Table 2.

TABLE 2. Dimensions of

	<i>Dr. bimaculata</i>		<i>Dr. monteверdensis</i>		<i>Dr. rubripes</i>		<i>Dr. panamae</i>	
MALES	MEAN		MEAN		MEAN		MEAN	
Dimensions in millimetres:	N = 3		N = 3		N = 2		N = 5	
F: Hind femur, length	9.29	10.23 (9.88)	12.18	11.95 (12.05)	9.11	9.66 (9.39)	9.07	9.93 (9.50)
FD: Hind femur, depth	2.15	2.27 (2.21)	2.51	2.45 (2.48)	1.99	2.04 (2.02)	1.90	2.06 (1.97)
L: Rostrum-subgen. plate	15.05	16.91 (15.88)	19.70	18.61 (19.26)	15.00	15.81 (15.41)	14.06	15.82 (14.82)
P: Pronotum (midline)	2.46	2.67 (2.59)	3.45	3.13 (3.32)	2.55	2.70 (2.63)	2.70	2.93 (2.77)
Interocular space	0.18	0.19 (0.19)	0.27	0.21 (0.24)	0.18	0.20 (0.19)	0.19	0.22 (0.20)
EE: (eye-eye)	3.16	3.48 (3.30)	3.82	3.65 (3.71)	3.14	3.35 (3.25)	3.16	3.28 (3.23)
Fastigium	0.38	0.41 (0.40)	0.50	0.47 (0.48)	0.19	0.31 (0.25)	0.33	0.59 (0.46)
Antennal pedicel (width)	0.38	0.40 (0.39)	0.55	0.46 (0.49)	0.38	0.41 (0.40)	0.41	0.43 (0.42)
Antenna	11.19	12.26 (11.66)	13.39	12.76 (13.07)	11.57	11.57 (11.57)	9.37	10.22 (9.61)
T1: hind tarsus 1	1.27	1.53 (1.39)	1.77	1.70 (1.73)	1.13	1.27 (1.20)	1.24	1.50 (1.33)
T2: hind tarsus 2	0.80	1.16 (0.98)	1.45	1.40 (1.43)	0.92	0.92 (0.92)	1.04	1.20 (1.12)
T3: hind tarsus 3	1.87	2.18 (2.05)	2.55	2.52 (2.53)	1.76	1.94 (1.85)	1.80	2.00 (1.88)
Ratios								
FD/F	0.21	0.24 (0.22)	0.21	0.20 (0.21)	0.21	0.22 (0.21)	0.20	0.22 (0.21)
F/P	3.78	3.88 (3.82)	3.82	3.53 (3.64)	3.57	3.58 (3.58)	3.25	3.66 (3.44)
L/P	5.94	6.33 (6.13)	6.22	5.52 (5.82)	5.56	6.20 (5.88)	5.20	5.57 (5.36)
Interoc./P	0.07	0.08 (0.07)	0.08	0.06 (0.07)	0.07	0.07 (0.07)	0.06	0.08 (0.07)
Interocular/pedicel	0.45	0.50 (0.48)	0.51	0.46 (0.49)	0.47	0.49 (0.48)	0.44	0.54 (0.48)
Fast/EE	0.11	0.13 (0.12)	0.14	0.12 (0.13)	0.06	0.09 (0.08)	0.10	0.18 (0.14)
(T1+T2+T3)/F	0.42	0.46 (0.46)	0.48	0.46 (0.47)	0.42	0.43 (0.42)	0.43	0.48 (0.46)
T2/ (T1+T2+T3)	0.20	0.25 (0.22)	0.25	0.25 (0.25)	0.22	0.24 (0.23)	0.25	0.27 (0.26)
Ant/Pronotum	4.24	4.69 (4.51)	4.28	3.78 (3.95)	4.54	4.54 (4.54)	3.30	3.77 (3.48)
EE/F	0.32	0.34 (0.33)	0.31	0.30 (0.31)	0.34	0.35 (0.35)	0.33	0.35 (0.34)
FEMALES								
Dimensions in millimetres:	N = 3		N = 3		N = 2		N = 4	
F: Hind femur, length	10.57	11.82 (11.12)	13.18	12.71 (13.01)	10.26	10.76 (10.51)	10.13	10.67 (10.40)
FD: Hind femur, depth	2.54	2.60 (2.56)	2.70	2.69 (2.73)	2.26	2.47 (2.37)	2.09	2.24 (2.14)
L: Rostrum-ovip.	17.11	19.36 (18.41)	22.18	21.76 (21.91)	17.28	17.43 (17.36)	18.06	16.89 (16.37)
P: Pronotum (midline)	3.00	3.07 (3.04)	3.84	3.72 (3.77)	2.86	2.86 (2.86)	2.84	3.05 (2.92)
Interocular space	0.28	0.31 (0.29)	0.33	0.32 (0.32)	0.24	0.25 (0.25)	0.26	0.33 (0.31)
EE: (eye-eye)	3.44	3.54 (3.48)	4.09	3.94 (4.01)	3.36	3.52 (3.44)	3.33	3.54 (3.43)
Fastigium	0.46	0.56 (0.51)	0.64	0.55 (0.59)	0.35	0.38 (0.37)	0.51	0.59 (0.54)
Antennal pedicel (width)	0.37	0.41 (0.38)	0.45	0.44 (0.44)	0.36	0.37 (0.37)	0.34	0.38 (0.36)
Antenna	9.37	10.79 (10.17)	11.40	10.00 (10.50)	no data		7.45	8.25 (7.98)
T1: hind tarsus 1	1.41	1.54 (1.49)	1.90	1.74 (1.83)	1.20	1.47 (1.34)	1.44	1.55 (1.50)
T2: hind tarsus 2	0.99	1.11 (1.03)	1.69	1.49 (1.57)	0.95	1.03 (0.99)	0.28	1.21 (0.96)
T3: hind tarsus 3	2.14	2.41 (2.24)	2.85	2.68 (2.79)	2.10	2.13 (2.12)	1.97	2.16 (2.10)
Ratios								
FD/F	0.22	0.24 (0.23)	0.21	0.20 (0.21)	0.22	0.23 (0.22)	0.20	0.21 (0.21)
F/P	3.52	3.85 (3.65)	3.53	3.38 (3.45)	3.59	3.76 (3.67)	3.32	3.72 (3.57)
L/P	5.70	6.31 (6.05)	5.85	5.78 (5.81)	6.04	6.09 (6.07)	0.00	5.89 (4.27)
Interoc./P	0.09	0.10 (0.10)	0.09	0.08 (0.09)	0.08	0.09 (0.09)	0.09	0.11 (0.11)
Interocular/pedicel	0.71	0.84 (0.77)	0.75	0.71 (0.73)	0.65	0.69 (0.67)	0.76	0.94 (0.87)
Fast/EE	0.13	0.16 (0.15)	0.16	0.14 (0.15)	0.10	0.11 (0.11)	0.11	0.15 (0.14)
(T1+T2+T3)/F	0.43	0.43 (0.43)	0.49	0.46 (0.48)	0.21	0.24 (0.22)	0.38	0.47 (0.44)
T2/ (T1+T2+T3)	0.21	0.22 (0.22)	0.26	0.25 (0.25)	0.42	0.42 (0.42)	0.07	0.25 (0.21)
Ant/Pronotum	3.12	3.51 (3.34)	3.06	2.63 (2.78)	no data		2.60	2.84 (2.73)
EE/F	0.29	0.33 (0.31)	0.03	0.02 (0.02)	0.33	0.33 (0.33)	0.31	0.35 (0.33)

The original description was based on a 60-year old museum series. Fresh new specimens from a nearby region (some 20 km higher up the Río Teribé) show that the types are badly discoloured. The description of the coloration must be amended as below.

MALE. General colour, dark green. Antennae, black; 21 flagellar segments. Eyes, black (brown when dried). Frons and genae blueish-white, with a black band running from eyes through antennal sockets and including the rostrum; lower edge of frons and genae edged black. Mouthparts black, palps white. Postocular stripe and vertex, black. Fastigium and inverted V marking on vertex, blue grey. Pronotum green, with black postocular stripe produced over lateral lobes to posterior border,

Drymophilacris spp.

<i>Dr. glyphocerca</i> n. sp.	<i>Dr. melanopsis</i> n. sp.	<i>Dr. nigrescens</i> n. sp.	<i>Dr. veraguensis</i> n. sp.
MEAN N = 5	MEAN N = 3	MEAN N = 5	MEAN N = 2
9.45 - 9.97 (9.68)	10.42 - 11.00 (10.74)	9.92 - 10.41 (10.09)	9.11 - 9.69 (9.40)
2.10 - 2.24 (2.18)	2.30 - 2.32 (2.31)	1.98 - 2.16 (2.10)	1.90 - 2.06 (1.98)
14.01 - 15.31 (14.64)	16.44 - 18.30 (17.27)	15.75 - 16.30 (16.01)	13.80 - 14.84 (14.32)
2.55 - 2.89 (2.75)	2.83 - 3.02 (2.94)	2.53 - 2.75 (2.67)	2.50 - 2.64 (2.57)
0.20 - 0.26 (0.22)	0.20 - 0.22 (0.21)	0.17 - 0.23 (0.19)	0.14 - 0.23 (0.19)
3.33 - 3.39 (3.36)	3.39 - 3.58 (3.48)	3.23 - 3.37 (3.29)	3.09 - 3.21 (3.15)
0.42 - 0.53 (0.48)	0.39 - 0.45 (0.42)	0.33 - 0.49 (0.39)	0.27 - 0.29 (0.28)
0.39 - 0.47 (0.43)	0.41 - 0.43 (0.42)	0.38 - 0.47 (0.42)	0.37 - 0.37 (0.37)
9.09 - 10.80 (10.11)	12.91 - 13.42 (13.21)	12.04 - 13.39 (12.47)	8.28 - 8.28 (8.28)
1.31 - 1.39 (1.36)	1.41 - 1.56 (1.47)	1.22 - 1.41 (1.33)	1.13 - 1.23 (1.18)
0.86 - 0.98 (0.94)	1.13 - 1.22 (1.19)	1.07 - 1.25 (1.13)	0.96 - 1.07 (1.02)
1.89 - 2.05 (1.98)	2.21 - 2.42 (2.30)	2.06 - 2.18 (2.11)	1.89 - 1.92 (1.91)
0.22 - 0.23 (0.23)	0.21 - 0.22 (0.22)	0.20 - 0.21 (0.21)	0.21 - 0.21 (0.21)
3.34 - 3.82 (3.52)	3.45 - 3.82 (3.66)	3.66 - 3.93 (3.78)	3.64 - 3.67 (3.66)
5.17 - 5.74 (5.33)	5.55 - 6.47 (5.89)	5.75 - 6.40 (6.00)	5.52 - 5.62 (5.57)
0.07 - 0.10 (0.08)	0.07 - 0.08 (0.07)	0.06 - 0.09 (0.07)	0.05 - 0.09 (0.07)
0.45 - 0.57 (0.52)	0.48 - 0.51 (0.50)	0.40 - 0.56 (0.47)	0.38 - 0.62 (0.50)
0.13 - 0.16 (0.14)	0.11 - 0.13 (0.12)	0.10 - 0.15 (0.12)	0.09 - 0.09 (0.09)
0.43 - 0.46 (0.44)	0.44 - 0.47 (0.46)	0.44 - 0.46 (0.45)	0.43 - 0.44 (0.44)
0.21 - 0.23 (0.22)	0.23 - 0.25 (0.24)	0.24 - 0.26 (0.25)	0.24 - 0.26 (0.25)
3.35 - 4.24 (3.68)	4.27 - 4.70 (4.50)	4.39 - 5.29 (4.68)	3.14 - 3.14 (3.14)
0.34 - 0.35 (0.35)	0.32 - 0.33 (0.32)	0.32 - 0.34 (0.33)	0.33 - 0.34 (0.34)
N = 5	N = 2	N = 5	
9.93 - 10.65 (10.38)	12.23 - 12.66 (12.45)	10.96 - 11.63 (11.33)	
2.38 - 2.56 (2.46)	2.68 - 2.77 (2.73)	2.29 - 2.41 (2.36)	
17.22 - 18.27 (17.79)	20.66 - 21.07 (20.87)	17.57 - 20.38 (18.58)	
3.16 - 3.30 (3.25)	3.47 - 3.63 (3.55)	2.83 - 3.30 (3.04)	
0.31 - 0.34 (0.32)	0.29 - 0.31 (0.30)	0.29 - 0.36 (0.32)	
3.42 - 3.61 (3.50)	3.74 - 3.79 (3.77)	3.55 - 3.68 (3.61)	
0.50 - 0.60 (0.53)	0.53 - 0.57 (0.55)	0.45 - 0.52 (0.49)	
0.39 - 0.41 (0.40)	0.43 - 0.44 (0.44)	0.37 - 0.40 (0.39)	
7.79 - 8.72 (8.31)	9.92 - 11.60 (10.76)	9.59 - 10.46 (9.92)	
1.32 - 1.50 (1.37)	1.67 - 1.73 (1.70)	1.36 - 1.54 (1.45)	
0.97 - 1.06 (1.01)	1.27 - 1.44 (1.36)	1.18 - 1.31 (1.23)	
1.84 - 2.07 (2.00)	2.71 - 2.71 (2.71)	2.20 - 2.39 (2.30)	
0.23 - 0.25 (0.24)	0.21 - 0.23 (0.22)	0.20 - 0.21 (0.21)	
3.01 - 3.29 (3.19)	3.49 - 3.52 (3.51)	3.48 - 3.87 (3.73)	
5.22 - 5.66 (5.48)	5.69 - 6.07 (5.88)	5.61 - 6.70 (6.12)	
0.09 - 0.10 (0.10)	0.08 - 0.09 (0.08)	0.10 - 0.11 (0.10)	
0.76 - 0.87 (0.81)	0.66 - 0.72 (0.69)	0.69 - 0.84 (0.77)	
0.14 - 0.18 (0.15)	0.14 - 0.15 (0.15)	0.12 - 0.14 (0.13)	
0.41 - 0.44 (0.42)	0.46 - 0.47 (0.46)	0.42 - 0.45 (0.44)	
0.23 - 0.24 (0.23)	0.22 - 0.25 (0.23)	0.24 - 0.26 (0.25)	
2.36 - 2.67 (2.56)	2.86 - 3.20 (3.03)	3.15 - 3.47 (3.27)	
0.33 - 0.34 (0.34)	0.30 - 0.31 (0.30)	0.31 - 0.33 (0.32)	

where the black band is punctuated by a single green spot; sulci black. Pterothorax and abdomen, green. Preterminal abdominal segments pale yellow ventrolaterally, genital region black. Spots on subgenital plate, supraanal plate and outer face of cerci, blue-grey. Fore and middle legs distal to midfemur, blue; proximal femur red, coxa yellow. Hind femora dark green, hind knee and hind tibia darker, suffused with blueish; hind feet brownish.

FEMALE. Generally similar to male. Metathoracic and abdominal segments 1-7 with an interrupted lateral yellow stripe, flanked dorsally and ventrally with diffuse black. Black stripes on pronotum bordered dorsally by a thin yellow stripe. Supranal plate yellow green. Hind femora paler green proximally.

8. *Dryomphilacris panamae* Descamps, 1976: reinstated combination

Descamps, 1976: 82.

Dryomacris panamae Descamps & Rowell, 1978: 357, 361.

Holotype male: PANAMA: Prov. Chiriquí: El Volcán: Cerro Punta, 5600 feet, Feb. 1937 (D.W. Bishop) (ANSP). Type examined. Note that Descamps omitted the true locality, Cerro Punta, from his original description; there is both a village and a mountain of that name, and they lie some 10 km NE of the town of El Volcán.

New records: PANAMA: Prov. Chiriquí: Volcán Barú, eastern slope, 1800 m, 26 Sept. 1999 (Rowell CHF, Bentos-Pereira A), 1 male, 1 allotype female, specimen nos. 99248 & 99246 (ANSP); 1 male, 1 female, specimen nos. 99247 & 99251 (UP); 4 males, 3 females, specimen nos. 99245, 99249-50, 99252-55 (RC). COSTA RICA: Prov. Puntarenas: Cerro Cruces, 6 km. S. of San Vito de Jaba, 5000'. 16 Mar 1969 (Rentz DC), specimen no. 69001 (RC). (This locality appears to be Cruces in the Cerro Zapote, 1476 m, LS 300600_575100, now completely deforested).

The holotype male is discoloured (possibly pinned from alcohol?) and the female has not been described previously.

REDESCRIPTION

Small for genus, and with relatively short antennae. Measurements: see Table 2.

MALE (Fig. 4). Elytra squamiform, reaching posterior edge of metathoracic notum. Furcula present, in form of two minute melanized projections. Supra-anal plate (Fig. 4C) 1.48X as long as broad, with a medial proximal depression; having a somewhat up-rolled, thickened margin, and ending in a bluntly pointed cylindrical process. Apical lip of subgenital rim rather long. Cercus (Fig. 4B-D) longer than supraanal plate, curving gently inwards, tapering smoothly to a rounded tip; lower edge bearing a ventrally and inwardly directed lobe 3/4 of the way to the tip.

Internal genitalia (Fig. 5). Phallic complex of same form as that of other members of the genus, but elongated along anterior-posterior axis until relatively nearly twice as long as that of e.g. *D. bimaculata*; epiphallus correspondingly unusually long for genus, only 0.62X as broad as long. Dorsal aedeagal valve straight, slightly shorter than ventral valves, symmetrically rounded at tip. Ventral valves project beyond posterior edge of capsule, ending in single recurved hooks, barbed on the inner surface (Fig. 5D).

Coloration. Antennae, black. Eyes, black (brown when dried). Mandibles blackish distally. Postocular stripe, marks on genae and V-mark on vertex dark green. Remainder of head metallic pale green with golden sheen (drying to dull light green).

Nota of pterothorax and disc of pronotum olive green, pronotal lobes shading to olive brown. Metallic green marks dorsolaterally at anterior rim of pronotum and anterior to each pronotal sulcus (vanish in dried specimens). Elytra olive green.

Front and middle legs pale reddish brown proximally shading to olive green at knee. Tibia and tarsi olive green. Tarsal spines and tarsal claws tipped black, pulvillus blackish. Basal 3/4 of hind femur, reddish brown, distally green, upper part of knee tinged brown. Hind tibia blue-green, shading to reddish brown distally, spurs brown; tarsal spines (6/7) blue-green, tipped brown. Hind tarsi pink, claws brown.

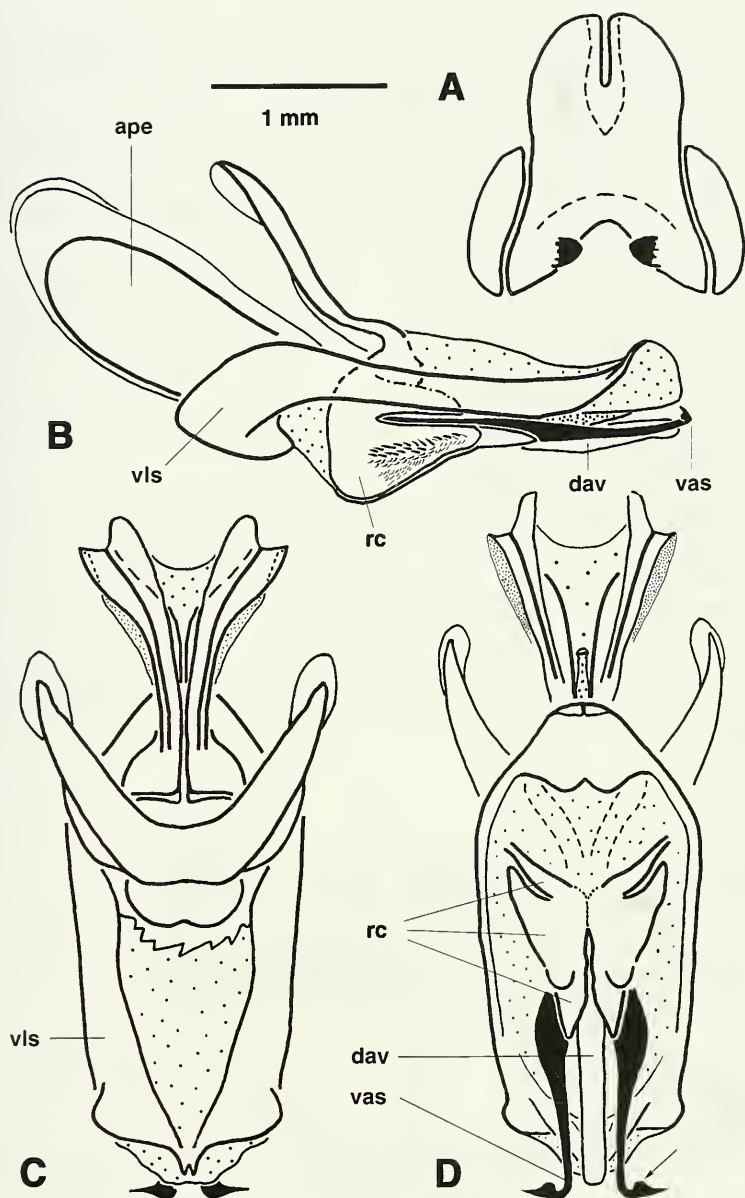


FIG. 5

Drymophilacris panamae Descamps, male. Internal genitalia. A, epiphallus. B-D, phallic complex in lateral, dorsal and ventral view. The ventral aedeagal valves are here coloured black for clarity, they are not heavily melanized in life. Arrow in D shows the "barb" on the appendage of the ventral valve. Abbreviations: ape, anterior process of endophallus; dav, dorsal aedeagal valve; rc, rami of cingulum and associated membranes; vas, ventral aedeagal sclerite; vls, ventrolateral sclerite.

First 8 abdominal segments olive green, paired darker green blotches dorso-laterally on each tergum. Segment 8 with metallic iridescence in life, lost at death. Segments 9-10 reddish brown, furcula and rim of 10th. tergum blackish. Cerci pale blue-green basally, black distally. Supraanal plate pale yellow-brown proximally, dark brown distally; it lacks the striking colours seen in other species of the genus. Subgenital plate a conspicuous light blue in life, medium dark grey-blue when dried, undivided by black medially; rim and pallium blackish. Underside purplish grey, darker medially. Sternum of 9th abdominal segment blackish.

FEMALE (Figs 6, 7). Elytron squamoid, extending to posterior margin of metanotum. Cerci (Figs. 7A-C) short, but abruptly narrowed to thin points. Subgenital plate (Fig. 7B) flat posteriorly, somewhat concave medially; proximally two paired swellings, easily visible in profile in side view of the abdomen (Fig. 7C); distal margin subtriangular, ending in an thick straight "egg guide" nearly equal in length to the ventral ovipositor valves; outer lobes densely haired.

Internal genitalia. Bursa copulatrix (Fig. 7D) long, thin, thick-walled, with two prominent dorsal thickenings at the base; the lumen is mostly as narrow as the duct and is only expanded over a short length near the entrance. Spermatheca (Fig. 7E); terminal ampulla rather long and thin, preapical diverticulum with a long narrow initial chamber, and a convoluted appendage bearing three small angular accessory diverticula.

Coloration. All adult and late larval females seen were of the bronze morph frequently found in this genus group; if there is a form coloured like the males, it is not common.

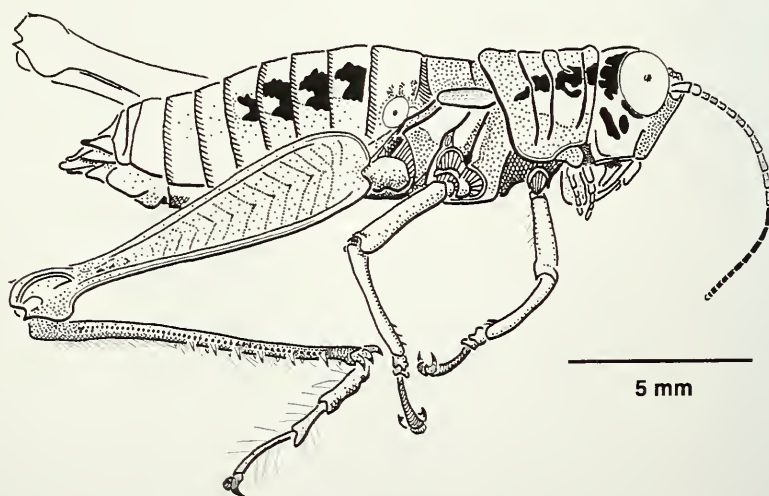


FIG. 6

Dryophilacris panamae Descamps, female. Habitus.

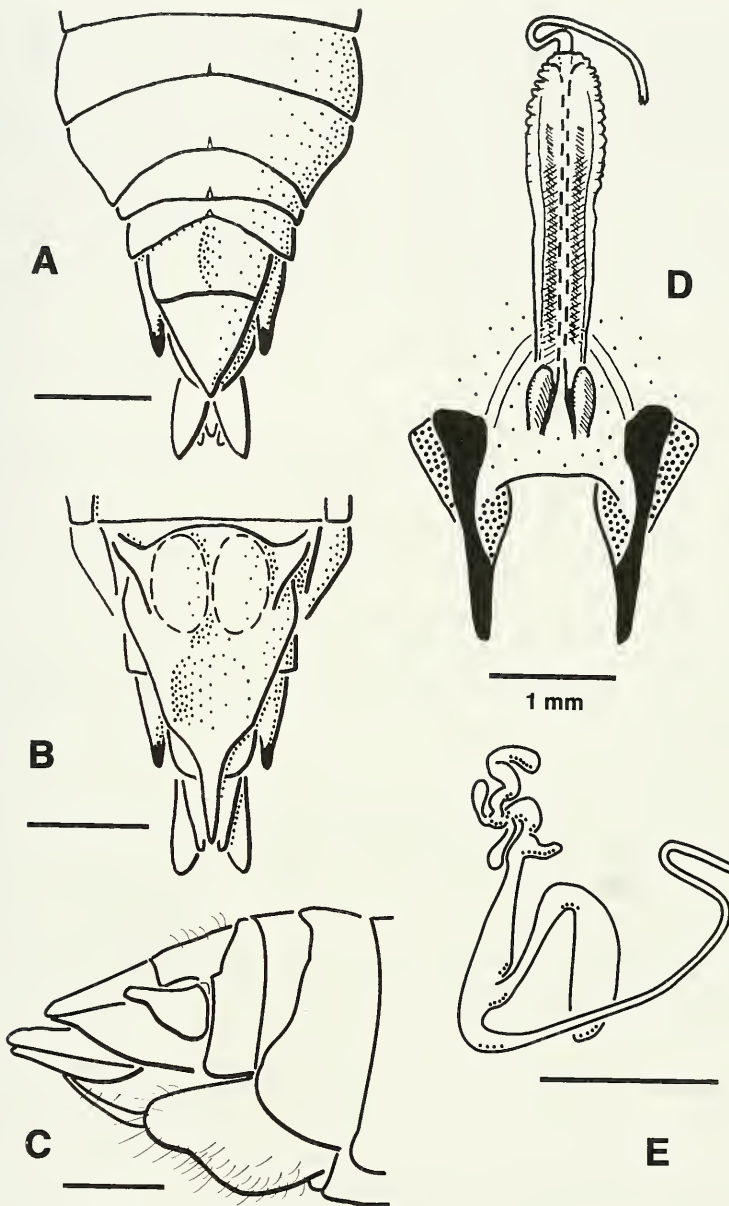


FIG. 7

Drymophilacris panamae Descamps, female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

Antennae: scape and pedicel yellow, flagellar segments 1-10 red, 11-20 black, 21 white. Eyes light purple-grey, with black pseudopupil (brown when dried). Labrum and clypeus, yellow brown. Palps greenish, blackish at base. Frons and anterior portion of genae, pinkish bronze. Posterior genae iridescent green (dries pale yellow brown) with a few black spots. Postocular stripe black. Vertex and fastigium brown, V-shaped mark on vertex green.

Dorsal surface of thorax, pinkish bronze. Postocular stripe continued onto upper lobe of pronotum as an irregular black stripe, bordered ventrally with iridescent green. Metathoracic epimeron and episternum metallic blue-green dorsally, shading to olive green ventrally. Elytron blackish brown.

Front and middle legs green; tibiae blackish distally, tarsi and pulvilli blackish brown. Hind femur and tibia green, upper part of knee tinged brown. Tarsi pink. Spines and spurs minutely tipped black.

Dorsal surface of abdomen, including supranal plate, pinkish bronze; all segments with grayish posterior border. Conspicuous black spot on the side of each notum of abdominal segments 2-4, each containing an ill-defined yellow blotch posteriorly. Abdomen widest at level of segment 7, thereafter narrowing abruptly to genital region. Tips of cerci, dorsal surface of superior ovipositor valves and tips of ventral valves blackish brown.

Underside of abdomen and thorax dark green laterally, in each segment shading to dark blue medially and posteriorly.

Dried specimens lose almost all the colour described above and become a uniform pale rufous brown with green legs and some black markings. The antennae retain their colours.

Natural History. The type locality, Cerro Punta, is now a centre of intensive vegetable horticulture with very heavy insecticide application, little natural vegetation and few living insects. It is reassuring that the species occurs in suitable localities on Volcán Barú, which is a National Park. It lives there on *Solanum* bushes at the forest edge, sharing them with a very large population of *Ampelophilus olivaceus* (Giglio-Tos), another lithoscirtan. In September, when we made our collection, the majority of individuals of *D. panamae* were still larvae; adults, especially females, were scarce, but the species is not uncommon in this locality.

Comment. At the time of our transfer of this species to *Drymacris* only the holotype male was available. The rather large squamiform elytra suggest this attribution, and the male cercus has a weak resemblance to that of *Drymacris nebulicola*. The diagnostic structures of the female subgenital plate and ovipositor, however, leave no doubt that the real genus is *Drymorphilacris*.

The specimen from Puntarenas Province, Costa Rica, is a fifth instar female larva, and precise determination is not easy. Its antennal coloration indicates either *Drymacris nebulicola* or *Drymorphilacris panamae*, which are also the geographically closest members of the genus group. The shorter antennae, small wing rudiment, long thin pointed cerci and flattened upper ovipositor valves confirm the latter identification. This is the first record of the species from Costa Rica; the locality lies some 50 km W of Volcán Barú.

9. *Dryophilacris glyphocerca* sp. n.

Holotype male: COSTA RICA: Prov. Cartago: P.N. Tapantí: Rancho Negro, 1735 m, LN 186300_560000, 7. Oct 1999 (Rowell CHF), specimen no. 99382. Allotype female: same data, specimen no. 99380 (both ANSP). Paratypes: As holotype, but specimen nos. 99364, 99372, 99378, 99379, 99383, 99384, 99387, 99388, 99389, 99395 and 99396 (all ANSP). Same, but specimen no. 99367 (f); COSTA RICA: Prov. Cartago: P.N. Tapantí: 0-1 km past entrance to reserve, LN 194000_559800, 8.Oct 1999 (Rowell CHF), specimen nos. 99403 & 99404 (2 m) (all MHNP). As holotype, but specimen nos. 99365, 99366, 99368, 99370, 99371, 99375, 99381 & 99416 (RC). COSTA RICA: Cartago: P.N. Tapantí: Sector La Represa: Rancho Negro, LN 186300_560000, 15. Aug 1997 (Delgado R), specimen nos. CRI002 592428 & 592429 (INBio). COSTA RICA: Cartago: P.N. Tapantí: R. Dos Amigos, 1480 m, LN 189500_560200, 15. Mar 1994 (Mora G), specimen no. CRI001 964083 (larva) (INBio).

Etymology: (Gr. *glyphis*, penknife, and *kerkos*, tail), referring to the form of the male cercus.

MALE (Fig. 8). Elytra rounded, squamiform, reaching to first 1/3 of meta-thoracic notum. Furcula barely perceptible. Supra-anal plate 1.33X as long as broad, in form like that of *D. panamae*. Lip of rim of subgenital plate shorter than in *D. panamae*. Sheathed aedeagus very large, projects above and beyond cerci. Cerci (Figs 8B-D) very similar to those of *D. panamae*, ventral lobe somewhat smaller and more angular at extremity. Antennal flagellum with 20 segments.

Internal genitalia (Fig. 9). Rather elongate phallic complex, similar to but less extreme than that of *D. panamae*. Epiphallus (Fig. 9A) approximately square in dorsal view, about equally long as broad. Superior valve of aedeagus (Fig. 9B, D) short, straight and very slender in both lateral and ventral view. Ventral valves of same form as in *D. panamae*, but project further and are less obviously barbed (Fig. 9C, D).

Coloration. Antennae black, proximally annulated in grey. Eyes black (brown when dried). Frons, clypeus, entire frontal ridge, genae, blue green. Labrum and mandibles, black distally, brownish proximally. Palps dark at base, tipped green. Fastigium green-gold; vertex greenish blue. Postocular stripe and some pitting on adjacent parts of gena, black.

Pronotum blue-green, its margins, sulci and continuations of post-ocular stripe, black. Meso- and metathoracic epimera and episterna, blue-green, sutures black. Elytron brown, central area green. Thoracic and abdominal nota blue-green with paired black chevrons, each bearing a gold mark. The black area diminishes in the later abdominal segments. Underside blueish green, medial area black.

Legs pale olive green, pulvilli and claws black. All feet red-brown. Hind knees, red brown. Hind tibiae green proximally, shading to red-brown distally; spines red-brown.

Genital area, black. Supra-anal plate metallic green-gold. Cerci black at tip, yellow-grey on outer face proximally. Subgenital plate gold-green, undivided in adult, medially divided into two spots in late larva.

In dried specimens the blue, gold and some black elements fade, leaving predominantly shades of green. The black of the antennae, mouthparts and genital area is however unaffected.

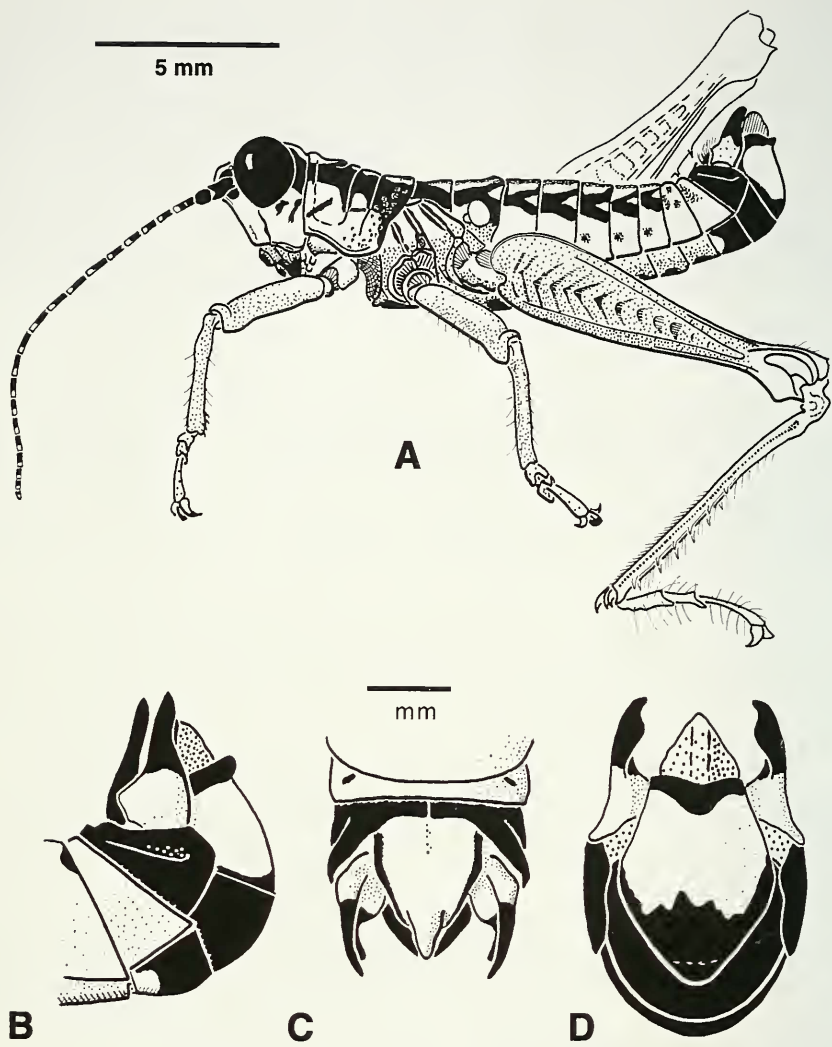


FIG. 8

Drymophilacris glyphocerca sp. n., male. A, habitus. B-D, external genitalia in lateral, dorsal and ventral views.

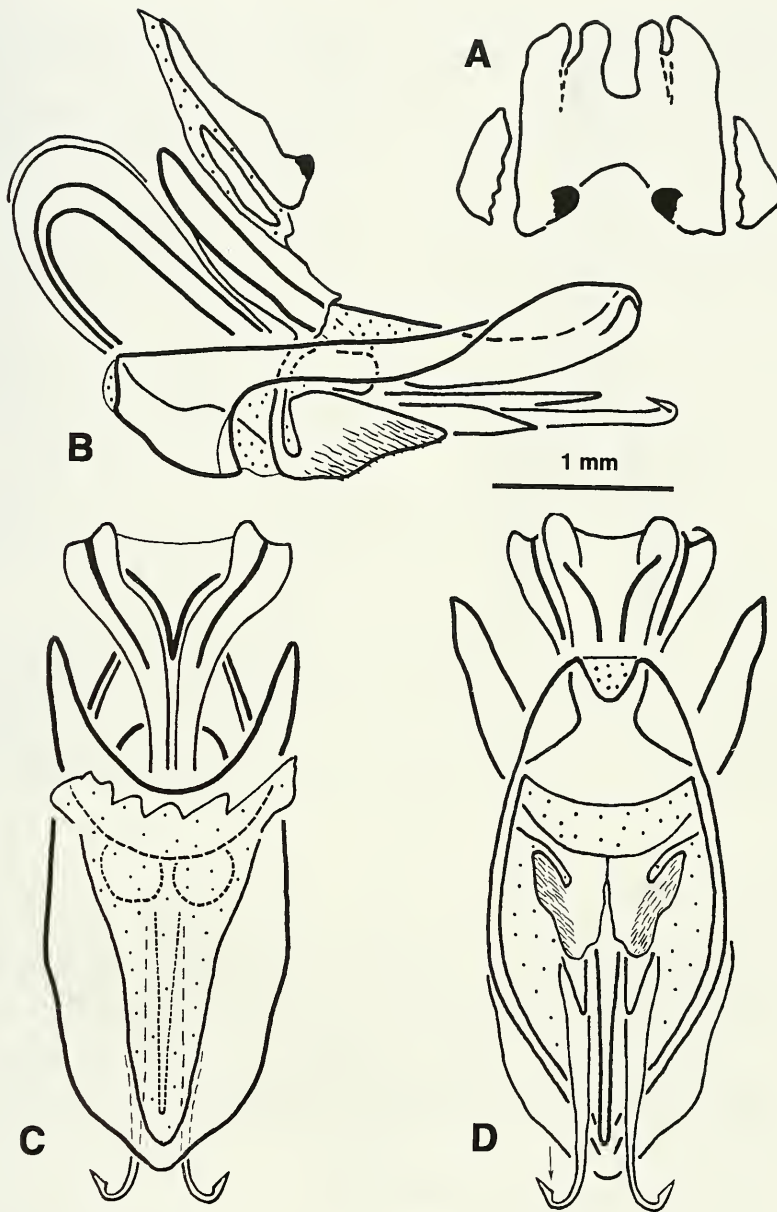


FIG. 9

Drymophilacris glyphocerca sp. n. male. Internal genitalia. A, epiphallus, dorsal view. B, phallic complex, lateral view. C, D, as B, but dorsal and ventral views respectively. Arrow in D shows the "barb" on the appendage of the ventral valve - compare with Fig. 5D.

FEMALE. Elytra rounded, squamiform, reaching to middle of metathoracic notum. Cerci (Fig. 10A-C) abruptly narrowed to long thin points. Subgenital plate (Fig. 10B) flat or slightly concave posteriorly; proximally two paired swellings, which are produced anteriorly onto the next abdominal sternum; distal margin subtriangular, ending in an "egg guide" equal to $2/3$ the length of the ventral ovipositor valves and markedly curved upwards at the tip; outer lobes densely haired. Antennal flagellum with 19-20 segments, median 20.

Internal genitalia. Bursa copulatrix (Fig. 10D) as in *D. panamae*. Spermatheca (Fig. 10E): preapical diverticulum with a short initial chamber and an appendage with 2 rounded accessory diverticula.

Coloration. Highly polymorphic in colour, with at least 4 variants - green like male, though with less black on pronotum; bronze; dull brown; and almost black. The first two forms can additionally have either red or green legs.

Antennae always red proximally, blue-black distally, with white tip separated from the blue area by a thin red band.

Relationships. The species seems close both ecologically and morphologically to *D. panamae*; both are alpine, small, have shorter antennae than usual in the genus, similar flanged male cerci, minute furculae, and barbed hooks on the tips of the ventral aedeagal valves.

Natural history. Occurs commonly above 1600 m on *Solanum* spp. in wet montane forest in the upper drainage of the Río Grande de Orosí and its tributary, the Río Macho, both draining the north-eastern Talamanca mountains. At high altitude (>2000 m) it is sympatric with *Drymacris nebulicola*, below 1600 m it is replaced by *Lithoscirtus daedalus*. Of the 28 specimens of the type series, three were parasitised by mermithid nematodes.

10. *Drymorphilacris nigrescens* sp. n.

Holotype male: PANAMA: Prov. Bocas del Toro: 1-3 km past watershed on road Fortuna-Chiriquí Grande, 1035-850 m, 24. Sept. 1997 (Rowell CHF Bentos A), specimen no. 97488. Allotype female: same data but 23. Sept 1997, specimen no. 97477 (both ANSP). Paratypes: same data as holotype, but dates between 18. and 27. Sept. 1997: specimen nos. 97452, 97453, 97462, 97480, 97486, 97487 & 97569 (all ANSP). As above, but specimen nos. 97472 & 97473 (2 males); as above, but 18.09.99, specimen no. 99126 (female) (all MHNP). As above, but specimen nos. 97451 (female) & 97461 (male) (UP). As above, but specimen no. 97509 (female) (RC). PANAMA: Prov. Bocas del Toro: Quebrada Felix, 2 km NW of summit of rd. to Chiriquí Grande, 900 m, 26. Sept. 1997 (Rowell CHF Bentos A), specimen nos. 97535 & 97536 (2 males) (ANSP).

Etymology: Latin *nigrescens*, dusky, blackish.

MALE (Fig. 11). Elytron extending over 50% to 90% of mesonotum, not reaching the posterior margin of the tergum. Furcula small but distinct. Tip of cercus with rounded obtuse upper and angular acute ventral corners. Supra-anal plate 1.18X as long as broad, tapering to a rounded tip, largely without the appendage seen in *panamae* and *glyphocerca*. Subgenital plate with a short medial lip.

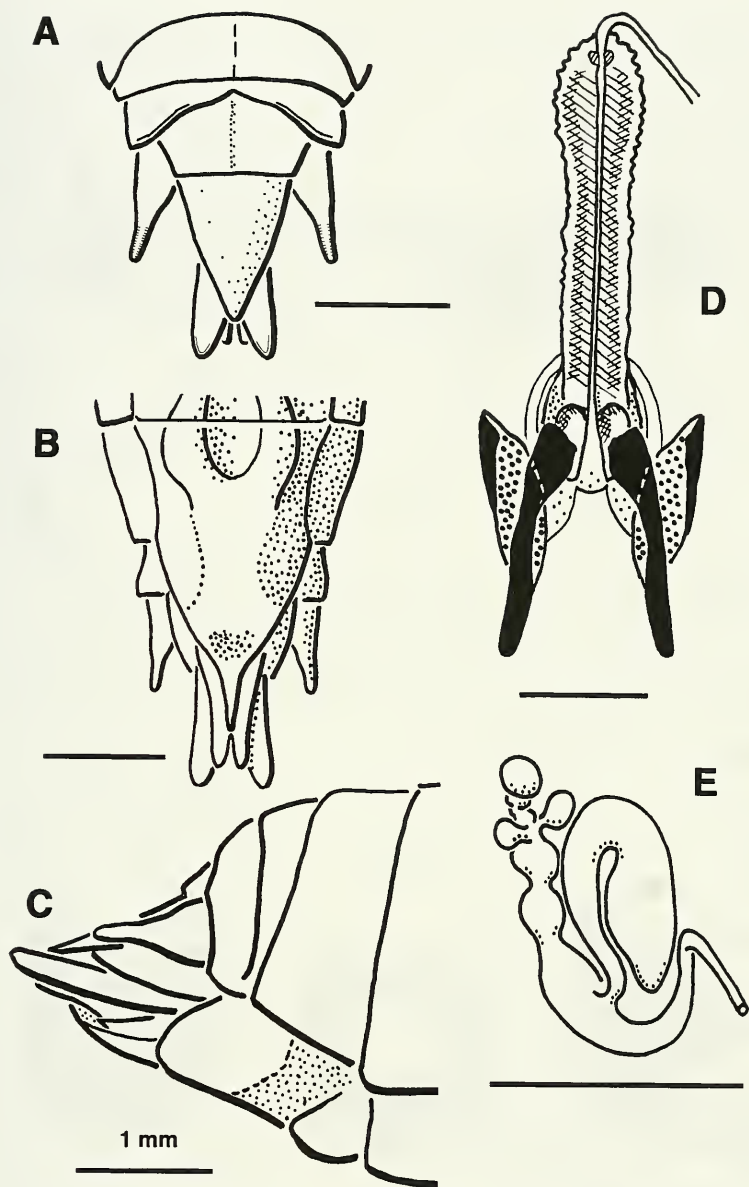


FIG. 10

Drymophilacris glyphocerca sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

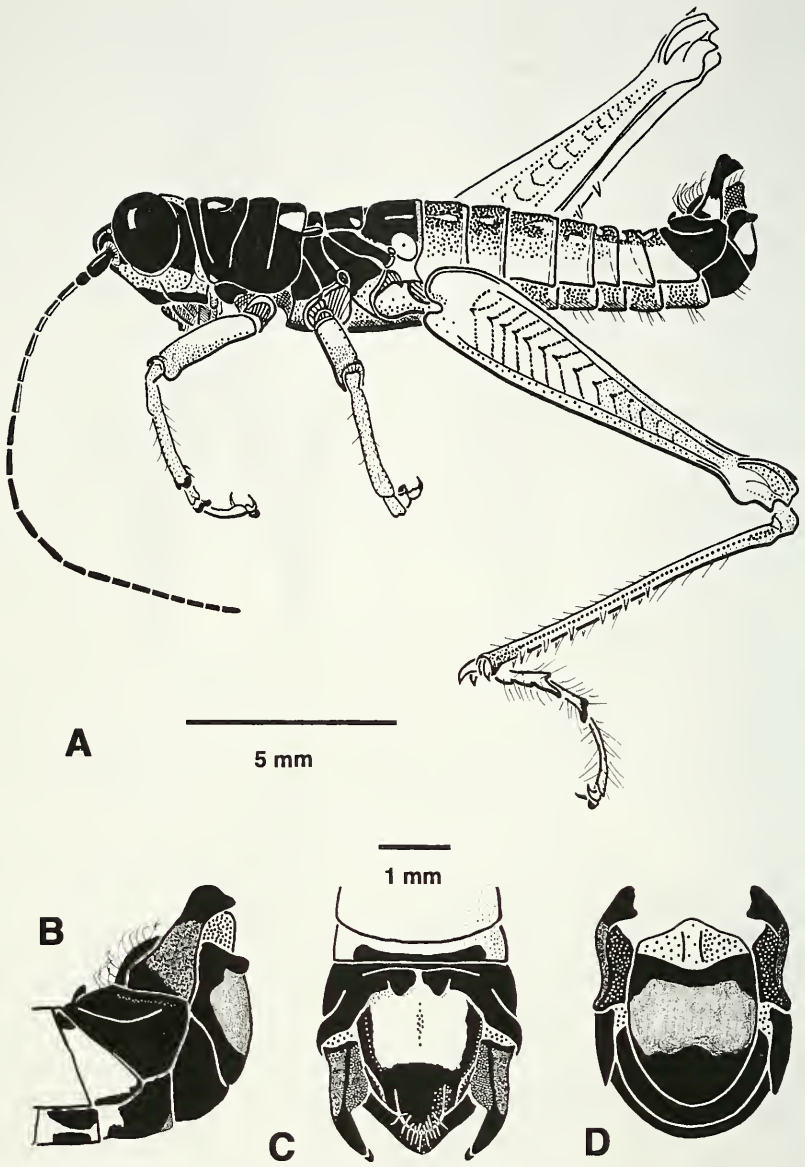


FIG. 11

Drymophilacris nigrescens sp. n. Male. A. habitus. B-D, external genitalia in lateral, dorsal and ventral views.

Internal genitalia (Fig. 12). Upper aedeagal valve slightly shorter than lower valves, laterally compressed, rather pointed, straight. Terminal appendages of lower valves a simple straight hook, unbarbed.

Coloration: Antennae black. Eyes black (red-brown when dried). Lateral ocelli, yellow. Palps black basally, green at tip. Mandibles, labrum, clypeus, ventral rim of genae, black. Antennal socket, black. Postocular stripe and most of genae, black. Frons and anterior central part of genae, grey-green or grey-blue, variably suffused with black. Frontal ridge in upper part always black, below medial ocellus variably so. Fastigium and vertex, dull yellow-green or blue-grey; V-marking on vertex black.

Pronotum mainly black. Anterior ventral angle green, a pair of green marks dorsolaterally at posterior margin, just anterior to elytra. In some individuals a variable amount of dark green marking medially on pronotal disc. Meso- and metathorax, black laterally and ventrally, dark green dorsally and medially, variously suffused black; a pair of poorly defined yellow dots dorsolaterally and posteriorly, in the black area of each segment. Elytra brown, traces of wings visible in some individuals.

Front and middle legs yellow proximally, dark green in distal femur and from thence distally. Pulvilli and claws blackish. Hind femur pale green proximally, dark green or blue-green distally, ventral surface light blue. Ventral lobes of knee light blue. Tibiae mainly blue, but green proximally and black distally; spines 6/7, blue, tipped red brown, spurs brown. Tarsi pinkish brown, claws and pulvilli blackish.

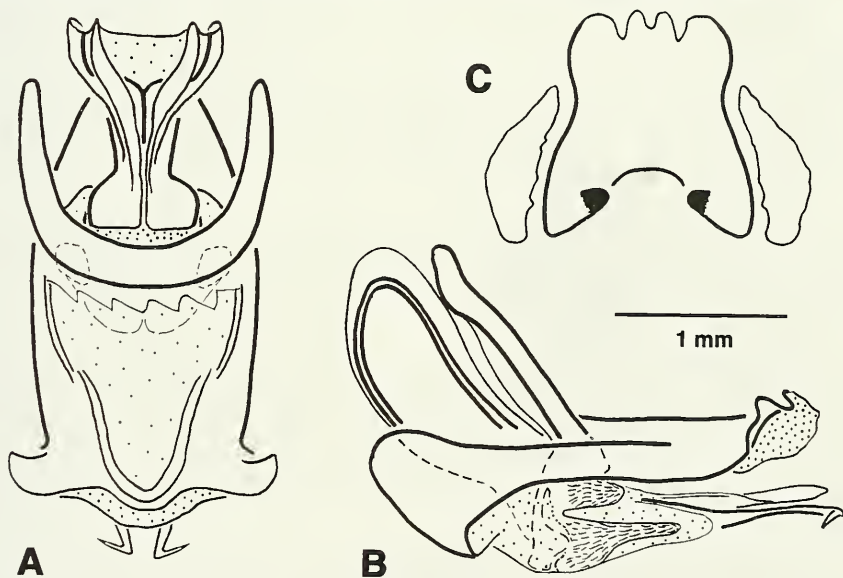


FIG. 12

Drymophilacris nigrescens sp. n., male. Internal genitalia. A, phallic complex, dorsal view. B, the same, lateral view. C, epiphallus, dorsal view.

Terga of abdominal segments 1-6 repeat pattern of meso- and metathorax; segments 7-9 are lighter. Sides of segments yellow, underside blackish, with blue posterior margins and yellow-brown anterior margins. Genital area (Figs 11B-D) mostly black. Furcula black. Tip of cercus with rounded dorsal and angular ventral corners, black, proximal part of outer face grey-blue or grey-green. Paired confluent spots of subgenital plate grey-blue. Supraanal plate with black rim and distal half, proximal central part yellow; distal half with long dense hairs.

FEMALE (Fig. 13). Elytra extend to posterior margin of mesonotum. Cerci typical of genus, but slightly downturned at tip in lateral view (Fig. 13C). Subgenital plate flat or concave distally, ending in an egg guide (Fig. 13D) that equals or exceeds the length of the ventral valves, downwardly hooked at the tip; anteriorly provided with two large laterally directed melanized swellings, clearly visible as lateral projections from above or below (Figs 13A, B).

Internal genitalia (Figs 13E, F) typical of the genus.

Coloration. Females are dimorphic in coloration.

Green form: coloration as male, except for antennae (distal 2 segments white), hind tarsi (grey) and genital area. Elytron greenish yellow, brown basally, reaching posterior edge of mesothoracic tergum. Sides of last three abdominal tergites black, forming a pair of conspicuous dark spots. Cerci yellow-green basally, black distally. Proximal half of supraanal plate green, terminal half blackish. Ovipositor valves light brown, blackish on dorsal face of superior valve. Subgenital plate brown laterally, blue grey medially; basal swellings, blackish.

Bronze form: entire body except legs reddish brown, with metallic sheen in life, lost after death; distal half of antenna black with white tip, postocular stripe darker brown. Yellow spots of the green form represented by light brown flecks. Front and middle legs green, tarsi and tibiae tinged brown. Hind femur green, knee area reddish brown, underside blue. Hind tibia red-brown, ventral surface blue, blackish at distal extremity. Tarsi light brown. Claws, spurs and pulvillus dark brown.

Relationships. Morphologically similar to the geographically adjacent *D. rubripes*, especially in the form of the female subgenital plate, but differing in the ventrally hooked egg guide. It also differs in its larger size and slightly longer fastigium, and markedly in coloration.

Natural history. On *Solanaceae* (mostly *Solanum* spp., esp. *S. ochraceo-ferrugineum*, but also *Witheringia solanacea*) and sometimes on *Vernonia* (Asteraceae) in clearings in montane forest, up to 1200 m (the highest available point). Not recorded below 550 m. Found to date solely on the Caribbean side of the watershed. Adults and all stages of larvae present in September. Mature females contain 2-6 eggs.

Comment. The species is remarkably similar in general coloration to a large undescribed *Hylopedetes* sp. (Rowell in prep.) with which it is sympatric. Especially green females of *D. nigrescens*, lacking the characteristic markings of the male genital region, can readily be confused with this rhytidochrotrine; the best field

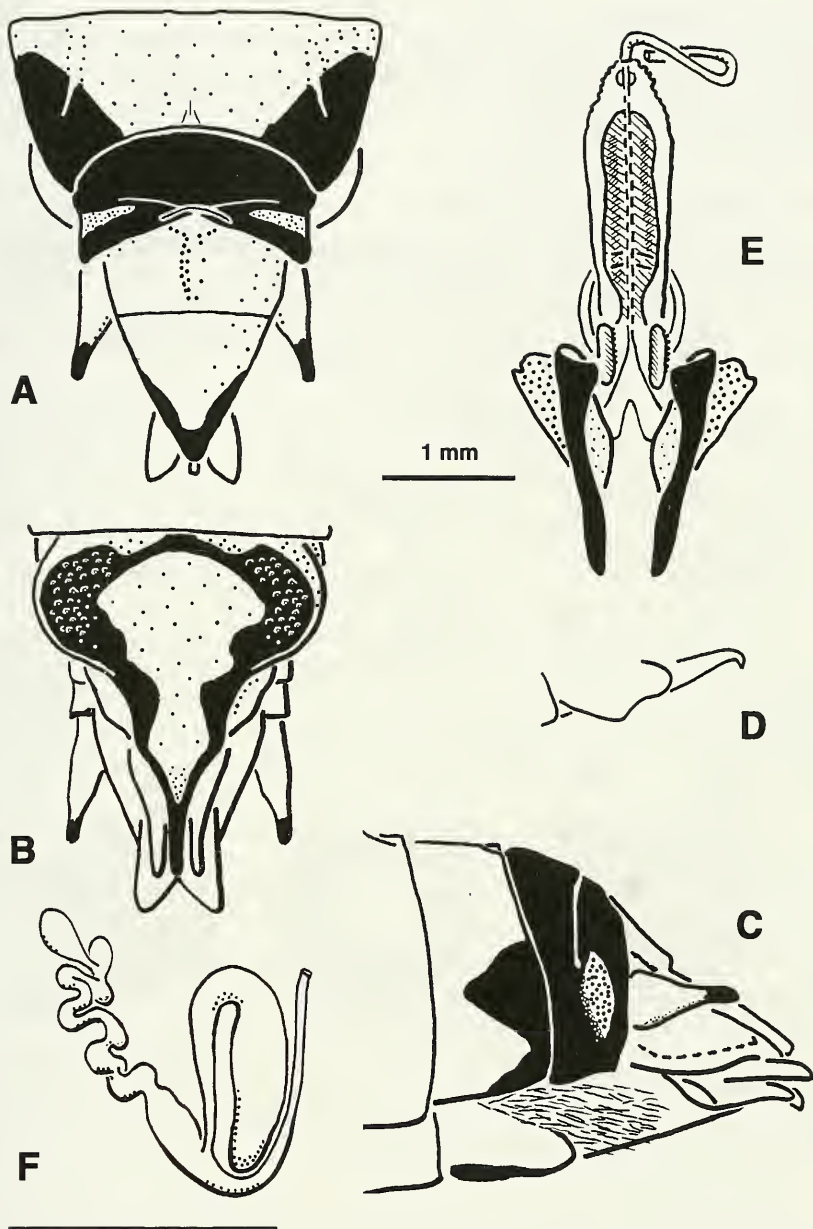


FIG. 13

Drymophilacris nigrescens sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca.

character under these circumstances is the length of the antennae, which in *Hylopedetes* are much shorter. The black and green males with twin yellow patches on the posterior edge of the pronotum are strongly reminiscent of *Lithoscirtus daedalus*, but differ in the bright yellow supraanal plate and the blue spots of the subgenital plate.

11. *Drymophilacris veraguensis* sp. n.

Holotype male: PANAMA: Veraguas Prov.: Santa Fé: Alto la Piedra, 900 m, 16. Sept 1999 (Rowell CHF, Bentos A), specimen no. 99096 (ANSP). Paratype male: same data, but 16. Nov 1999 (De Gracia L, Santos A, Gonzalez P), specimen no. 99520 (UP).

Etymology: coming from Veraguas, the province in which the type locality is located.

MALE (Fig. 14). Elytron minute, falling well short of posterior margin of the mesonotum; wing absent. Furcula quite well developed. Cerci incurving, rounded at the dorsal tip, angular at the ventral tip, similar to those of *D. nigrescens*. Supraanal plate 1.23X as long as wide, and tip blunter and more rounded, most similar to that of *D. nigrescens*.

Internal genitalia (Fig. 15). Very similar to those *D. nigrescens*, but dorsal aedeagal valve equal in length to ventral valves, truncate at tip.

Coloration. Antennae black (but flagellar segments distal to no. 16 missing in both specimens). Eyes black (brown when dried). Clypeus, labrum and mandibles black, palps yellow. Remainder of head yellow, except for black antennal sockets, black mark on upper part of frontal ridge between the two antennal sockets, black postocular stripe, small black fleck in centre of fastigium, and inverted black V on vertex.

Pronotum yellow, with one medial and two lateral black stripes continuing the markings of the vertex and the post-ocular stripe posteriorly; these stripes continue as far as the first abdominal segment. Pronotal epimeron black. Elytron brown. Meso- and metathoracic epimera and episterna yellow with longitudinal black marks. Fore and mid legs, yellow. Hind femora green, upper lobe of knee tinged red-brown. Hind tibia green; 6 external and 7 internal tibial spines, tipped red-brown, tarsal spurs tipped black. Tarsi yellow, claws tipped black.

Abdominal segments greenish-yellow. Dorsa of segments 6-8 bright yellow medially. Genital region (see Fig. 14B-D) mostly black; central area of suprananal plate, spots on subgenital plate, bright yellow. Cerci black, with a grey-green region on the central part of the outer surface of the shaft.

FEMALE unknown.

Relationships. As far as can be judged from the male alone, this species is most closely related to *nigrescens* and *rubripes*, which are also the closest geographically.

Natural history. Found on *Solanum* plants at forest edges.

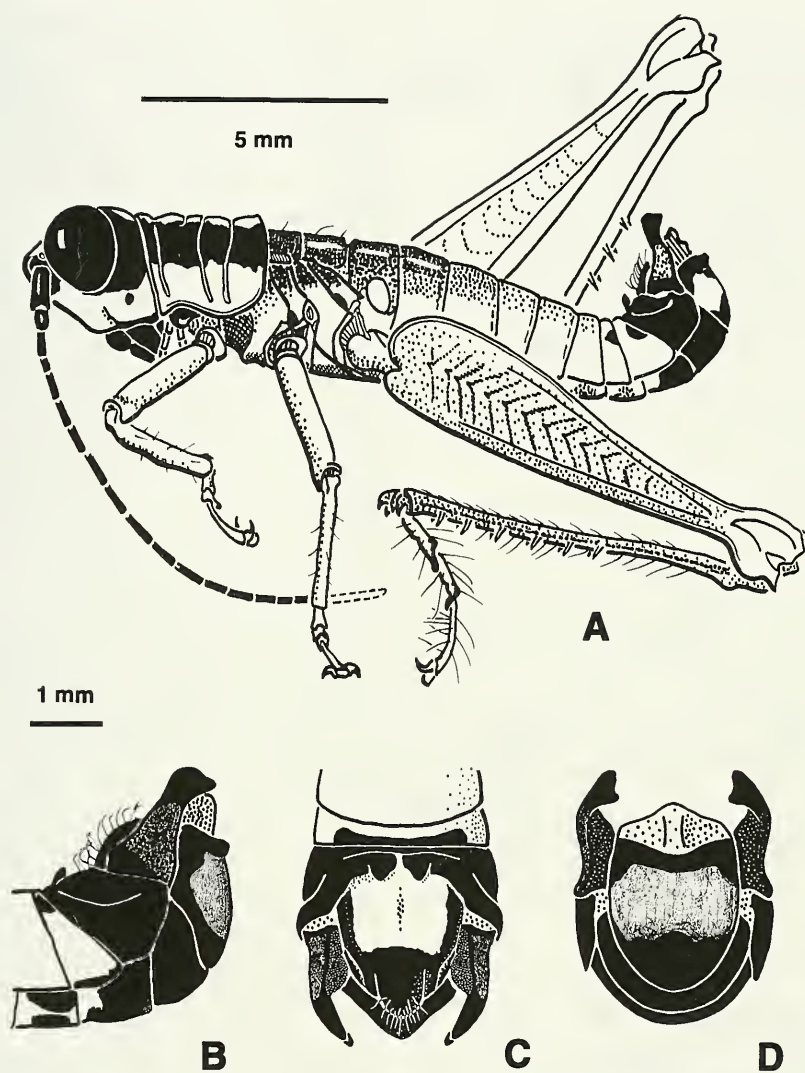


FIG. 14

Drymophilacris veraguensis sp. n., male. A, habitus. B-D, external genitalia in lateral, dorsal and ventral views.

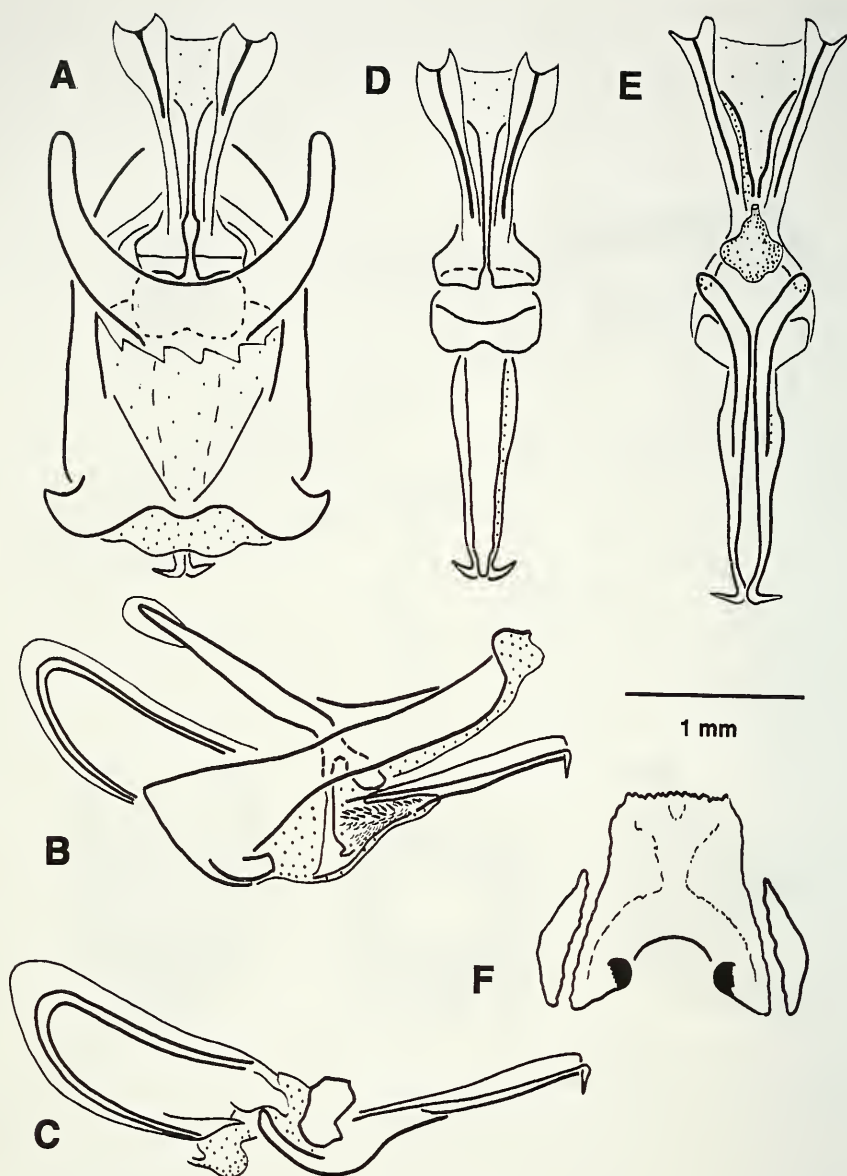


FIG. 15

Drymophilacris veraguensis sp. n., male. Internal genitalia. A, phallic complex, dorsal view. B, the same, lateral view. C, epiphallus, dorsal view.

12. *Dryophilacris melanopsis* sp. n.

Holotype male: PANAMA: Prov. Coclé: Cerro Copé: 830 m, 20 Sept 1997 (Rowell CHF, Bentos A), specimen no. 97400 (ANSP). Paratypes: as above, but 13-15 Sept 1999: one male, specimen no. 99084, one female, specimen no. 99076 (ANSP); one male, specimen no. 99094, one female, specimen no. 99085 (RC).

Etymology: *melanopsis* Gr., black face, noun in apposition.

MALE (Fig. 16). Elytron rather large for the genus, reaching clearly into the metathoracic notum. Furcula well developed, with widely separated points directed obliquely upwards. Supraanal plate almost glabrous anteriorly, entirely yellow with a thin black/red-brown rim, 1.37X as long as broad, with a prominent appendage terminally; cerci somewhat sigmoid and narrowly waisted behind tip in lateral view, tip broad and spatulate, dorsal corner rounded, ventral corner more acute.

Internal genitalia (Fig. 17). Epiphallus (Fig. 17C) longer than broad, deeply notched on anterior edge, and wider anteriorly than posteriorly, unlike other species of the genus; oval sclerites small. Phallic complex rather short and wide, relative to other species, and unique in having double recurved hooks at the tip of the ventral aedeagal valves (Fig. 17 A, B, D).

Coloration. Antennae black, terminal 2 segments white (uniquely for males of the genus); 21 flagellar segments. Eyes black (red-brown when dried). Palps green. Mandibles, labrum, clypeus, frons, antennal sockets, postocular stripe, lower edge of genae, glossy black. Upper part of genae, lemon yellow. Fastigium and vertex, lemon yellow; inverted V-marking on vertex, black.

Pronotum green dorsally, with darker dorsolateral stripes continuing line of post-ocular stripes. Ventral half of lateral lobes lemon-yellow, continuing line of genae. Two short yellow stripes dorsolaterally posterior to hind sulcus, continuing the line of the elytra. Pronotal epimeron, green. Meso- and metasternal interspace, blackish. Elytron, yellow.

Fore and middle legs green, pulvilli black. Hind femur green, knee reddish brown. Hind tarsus green, blackish-brown distally, spurs and tibial spines (6/7) blackish brown. Tarsi blackish brown, pale olive dorsally, claws and pulvilli tipped black.

Abdominal segments green dorsally, blackish brown ventrally. A pair of longitudinal yellow lines run dorsolaterally from the metathoracic notum to the genital region. Genital region (see Fig. 16B-D). Tergum 9 black, tergum 10 (with furcula) brown anteriorly, black posteriorly. Supraanal plate entirely yellow with a thin black/red-brown rim. Cerci green proximally, black distally. Paired spots of subgenital plate lemon yellow.

FEMALE (Fig. 18). Elytron extends on to metathoracic notum. Cerci typical of genus. Subgenital plate (Fig. 18B) flat, with low, laterally spreading, paired swellings with rugose cuticle anteriorly, triangular posteriorly, terminating in a straight, pointed, upward slanting egg guide (Fig. 18F), 0.7X as long as the ventral ovipositor valves.

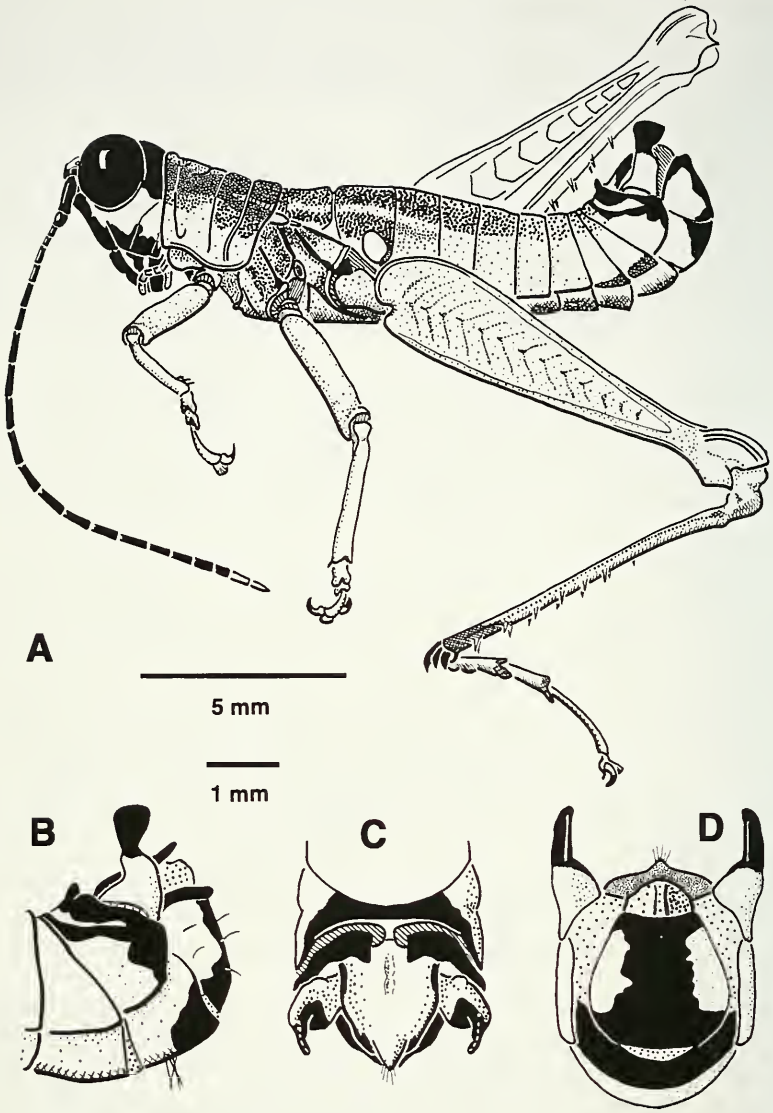


FIG. 16

Drymophilacris melanopsis sp. n., male. A. habitus. B-D, external genitalia in lateral, dorsal and ventral views.

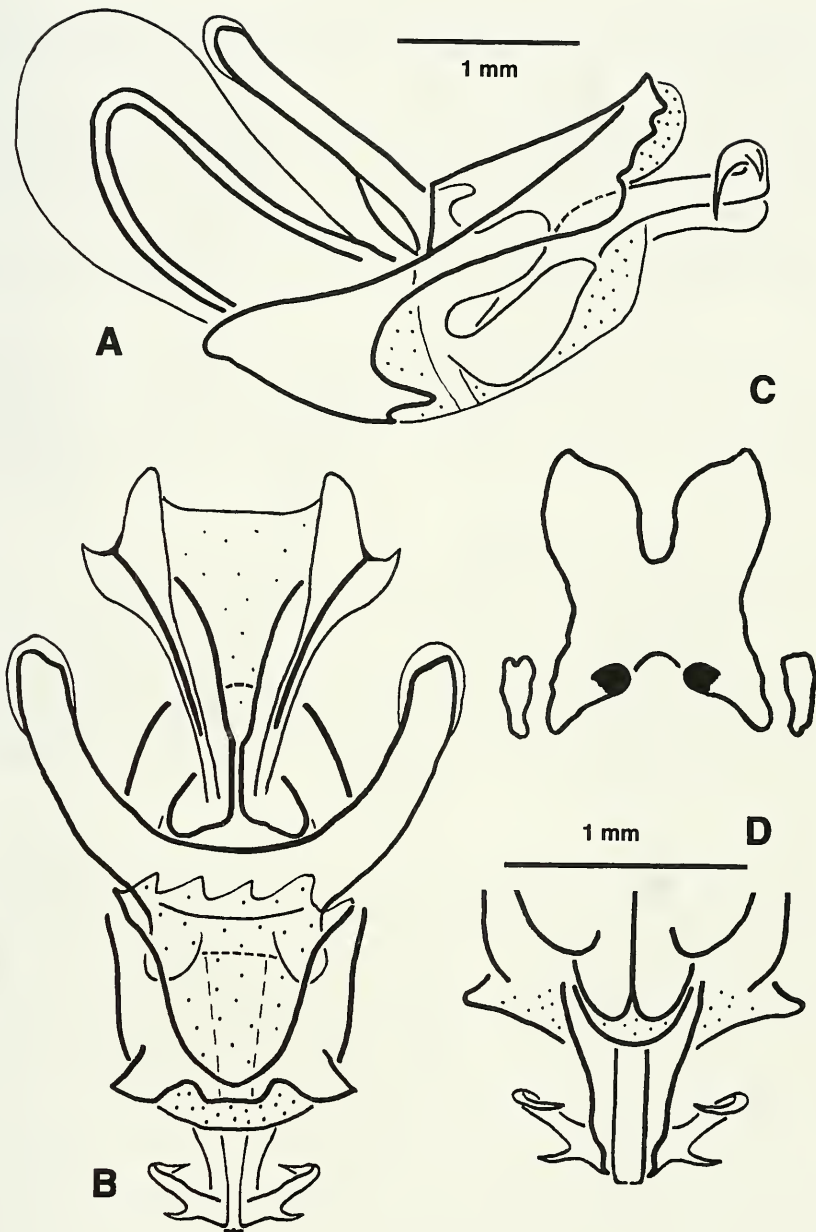


FIG. 17

Drymophilacris melanopsis sp. n., male. Internal genitalia. A, phallic complex, lateral view. B, the same, dorsal view. C, epiphallus, dorsal view. D, tip of aedeagus, ventral view.

Internal genitalia. Bursa copulatrix long and wide (Fig. 18D). Spermatheca (Fig. 18E) with a long convoluted appendage to the lateral diverticulum, bearing 3 or 4 accessory diverticula.

Coloration: as in male, except white tip of antenna includes the 3 terminal segments, and except for genital region. Supraanal plate, mottled olive green, tip tinged brown. Cerci olive brown, darker at tips. Ovipositor valves brown, dorsal valves black distally. Subgenital plate predominantly blackish in colour.

Relationships. A morphologically distinctive species, which does not seem to be closely related to any other member of the genus, and the second largest described to date.

Natural history. The insect is found on species of *Solanum* and *Witheringia* along paths and in treefall clearings in montane forest, on both sides of the Pacific/Caribbean watershed. One male (99084) contained a mermithid nematode and undeveloped testes. The remaining specimens were sexually mature, the females each containing 6 eggs.

Drymacris Descamps & Rowell, 1978

Descamps & Rowell, 1978: 358, 361. Type species: *Lithoscirtus nebulicola* Rehn, 1929: 26. Amédégno & Poulain, 1987: 400.

The genus originally contained three species: *nebulicola* (Rehn, 1929), *panamae* Descamps, 1976, then known only from the male holotype and here transferred to *Drymophilacris*, and *ovatipennis* (Rehn, 1905), then known only from the female holotype and transferred to *Paratela* by Descamps & Rowell (1984) following discovery of the male. The genus is now monospecific.

REDESCRIPTION

Medium-small grasshoppers (>9.9 , <20 mm in length); body length 15 (males) - 19 (females) mm. Pronotum relatively longer than in *Lithoscirtus* and *Drymophilacris*. Hind femur 3.2 (females) - 3.5X (males) as long as pronotum, rather slender, 0.19 - 0.20X as deep as long. Hind foot longer than in the other genera, 0.48X (females), 0.50X (males) as long as femur, second tarsal joint makes up 0.27 of foot. Interocular space narrow, 0.36X (males), 0.65X (females) as wide as antennal pedicel. Antennae 4.0X (males), 3.1X (females) as long as pronotum. Fastigium slightly longer than in the other genera.

Elytra much larger than in the other two genera, cycloid and extending beyond the posterior margin of the metanotum.

Male cerci abruptly notched on the ventral margin towards the tip. Internal genitalia very similar to those of *Drymophilacris*, but rather shorter and wider than usual in that genus; epiphallus 1.6X as wide as long.

Female cerci (Fig. 19A, C) short, bluntly rounded at the tip, unlike the other two genera. Upper ovipositor valves (Fig. 19A, C) relatively unmodified, less flattened dorsoventrally than in the other genera, slightly excavated dorsally, with a raised, minutely toothed, internal edge. Subgenital plate (Fig. 19B, C) flat, neither

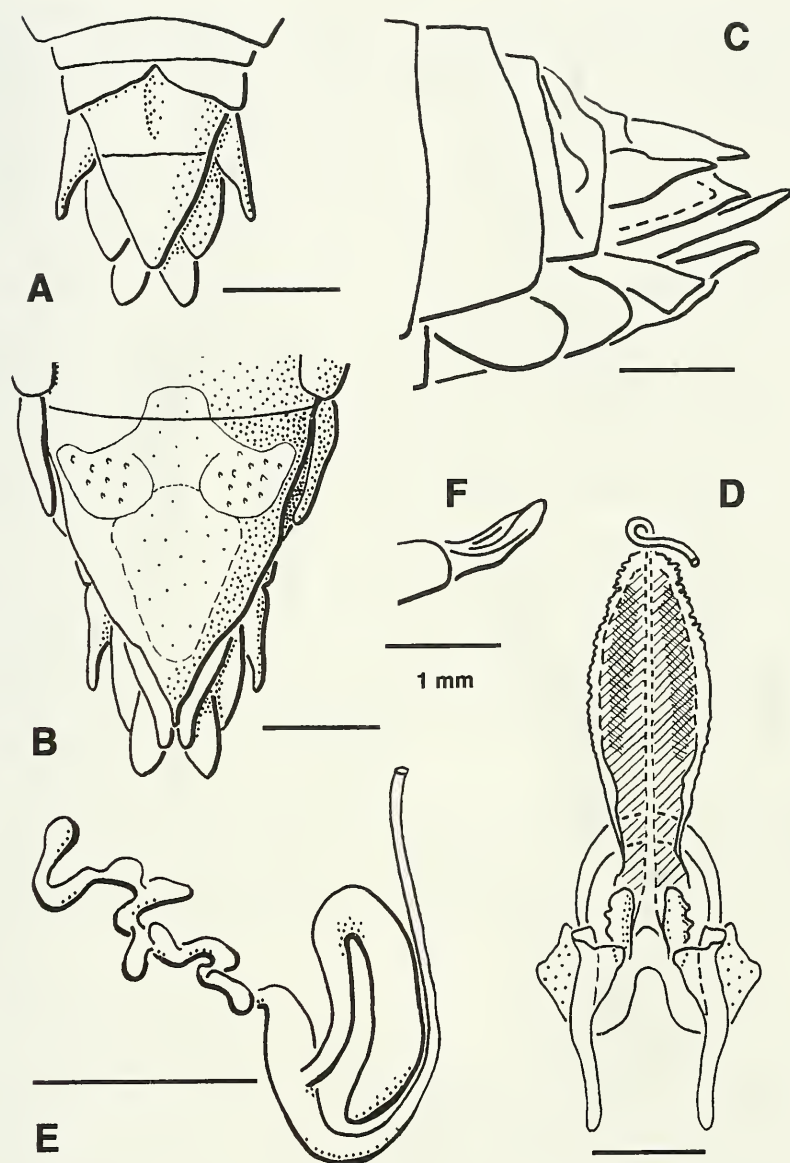


FIG. 18

Drymphylacris melanopsis sp. n., female. Genitalia. A-C, external genitalia in dorsal, ventral and lateral views. D, ventral ovipositor valves and bursa copulatrix. E, spermatheca; F, extremity of subgenital plate ("egg-guide") in lateral view.

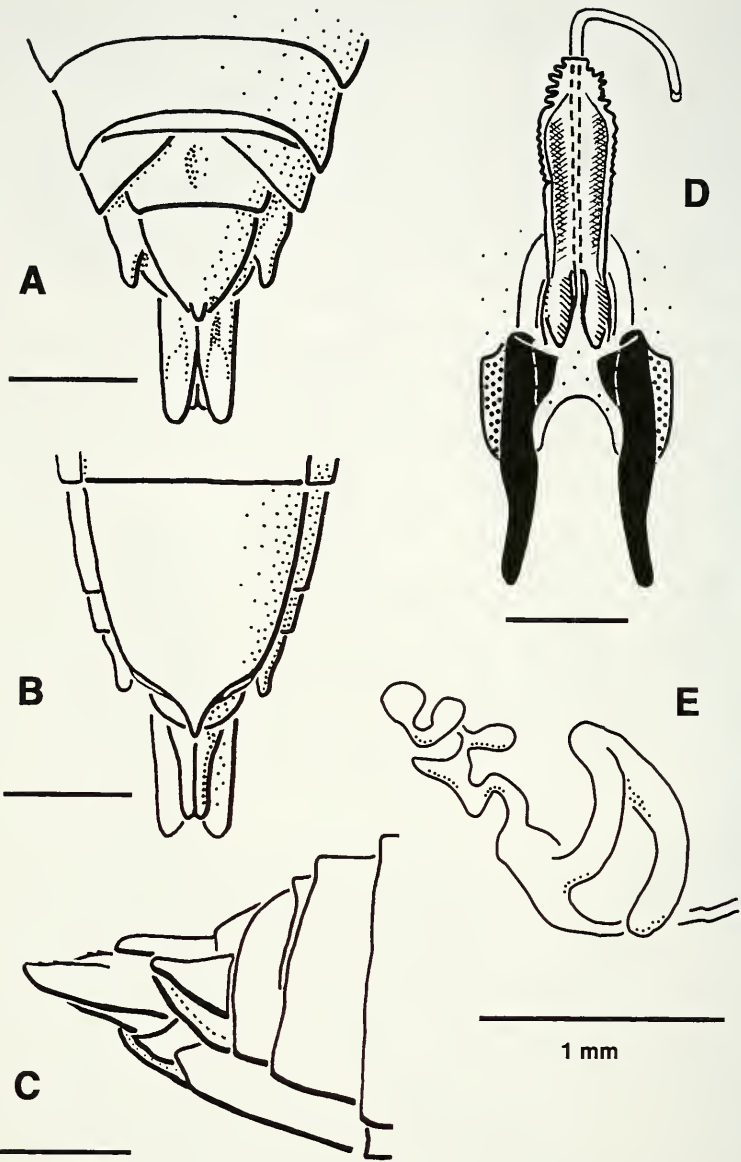


FIG. 19
Drymacris nebulicola (Rehn, 1929), female. A-C, external genitalia in dorsal, ventral and lateral views. D, bursa copulatrix. E, spermatheca.

domed (*Lithoscirtus*) nor provided with paired anterior swellings (*Drymophilacris*); terminal process ("egg-guide") very short. Terminal ampulla of spermatheca (Fig. 19E) rather long and narrow relative to the other two genera; appendage of lateral diverticulum with several small diverticula.

13. *Drymacris nebulicola* (Rehn, 1929)

Lithoscirtus nebulicola Rehn, 1929: 26. Transferred to *Drymophilacris*, Descamps, 1976: 81. Transferred to *Drymacris*, Descamps & Rowell, 1978: 361.

Holotype male and allotype female: COSTA RICA: La Palma, between Volcan Barba & Volcan Irazú, 4960-5100 feet, 1 Sept. 1923 (J.F. Tristán & J.A.G. Rehn) (ANSP).

New records: COSTA RICA: Prov. Cartago: Reserva Forestal Río Macho, Alto Roble, 2200 m, LN 190000_552300, 12 Oct. 1999 (Marshall S), specimen no. 99471 (RC). Tres Ríos: Cerro la Carpintera, 1700-1800 m, LN 207600_538600 21 Sept 1993 (Rowell CHF), specimen nos. 93310 & 93311 (RC). Below pass between Volcán Irazú and Volcán Turrialba, S. side, 1900-2000m, LN 217000_562500, 6 July 1980 (Rowell CHF, Rowell-Rahier M, Hyde C).

Prov. Heredia: 5 km. S of Los Cartagos (crossing of Rta 9 & R. Tabor), 1750 m, LN 232730_518480, 8 Sept 1993 (Rowell CHF), specimen no. 93203 (RC). San Rafael de Vara Blanca, 1800-2000 m, LN 239800_524200, 13 April 1986 (Rowell CHF, Braker HE), specimen nos. 86019-86022 (RC).

Prov. Puntarenas: Potrero Grande: Tres Colinas, 1945-2150 m, LS 342100_565600, 12 Sept 1995 (Rowell CHF, Meier V), specimen nos. 95540-95542 (RC). Monteverde: Sendero Nuboso, 1480-1520 m, LN 253500_449400, 14 July 1980 (Rowell CHF, Rowell-Rahier M, Hyde C, Braker HE).

Prov. S. José: Between Cascajal and Tierras Morenas, 1600-1700 m, LN 224000_543400, 18 Sept 1993 (Rowell CHF). S. Gerardo de Dota, 2000-2500 m, LS 387400_482700, 24 Feb 1992 (Curso Tachinidae y Syrphidae), specimen no. CRI000 407614 (INBio).

Fig. 19 shows the previously unillustrated female subgenital plate (19B, C) and internal genitalia (Figs 19D, E).

Dimensions, Table 1.

Distribution. The species is now known to be widely distributed in the higher montane forest zone of Costa Rica on both Atlantic and Pacific watersheds. Descamps & Rowell (1978) noted occurrences in Chompipe (near the type locality in the Cordillera Central) and in Monteverde (Cordillera del Norte). Further new records see above.

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